Spreckels SUGAR BEET Bulletin

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SPRECKELS SUGAR BEET BULLETIN

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TAKE YOUR CHOICE

The two extremes pictured above yielded the same sugar per acre.

THINNING
WEED CONTROL
HARVESTING

Under a mechanized plan can be profitably accomplished with a wide tolerance of spacing in the row.

Vol. 17 JANUARY - FEBRUARY, 1953 No. 1
PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

COMPARATIVE YIELDS FROM HAND AND MECHANICALLY THINNED FIELDS

By AUSTIN ARMER

Agricultural Engineer, Spreckels Sugar Company

IT HAS long been the policy of the Spreckels Sugar Company to recommend to growers the adoption of certain cultural practices, only when those practices have proved beyond any doubt that they possess genuine advantages.

The merits of mechanical thinning have been so well demonstrated over the past five years in the states of Colorado, Minnesota, North Dakota, and Michigan, that the company felt no reluctance in recommending mechanical thinning to its growers. But part of the company's obligation was to determine with some precision, what, if any, losses in yield might be expected from mechanically thinned beets, and to estimate the cost savings, if any.

As far back as 1949, the company conducted a series of trials to determine the actual dollar value of beets hand and mechanically thinned, all field conditions being equal. These experiments revealed that there was a slight reduction in the dollar value of beets harvested from mechanically thinned plots, but that this reduction was more than offset by the savings in thinning labor.

1952 INVESTIGATIONS

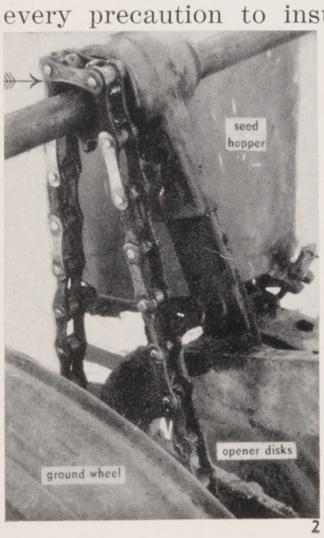
Thinning machines and methods improved a great deal between 1949 and 1952, so it was decided to redetermine the performance of mechanical thinners, and if possible to make this redetermination under strictly commercial conditions and in large enough plots to assure dependable results.

Two large scale experiments of mechanical thinner performance were made in the Sacramento valley. The cooperating growers were Jerry Fielder of Dixon and Fred Tadlock of Woodland.

THE FIELDER TRIAL

Mr. Fielder elected to conduct his own large scale experiment. He laid out a forty acre field into four ten-acre strips, of which the first and third were hand thinned, while the second and fourth were thinned with a Dixie beet thinner. Mr. Fielder took every precaution to insure good results, starting with careful seed bed preparation, planting at a fairly high rate and irrigating for germination.

In order to secure a sufficient rate of planting from a John Deere No. 66 planter, Mr. Fielder doubled the speed of the countershaft on this planter by driving it with an extended pitch roller chain operating on a nine-tooth sprocket. **This detail is mentioned because of the importance of planting enough seed to guarantee a seedling stand almost entirely free from large gaps.** The actual seeding rate was increased to 7 pounds of processed seed per acre, after planting some of the field at 5 pounds.



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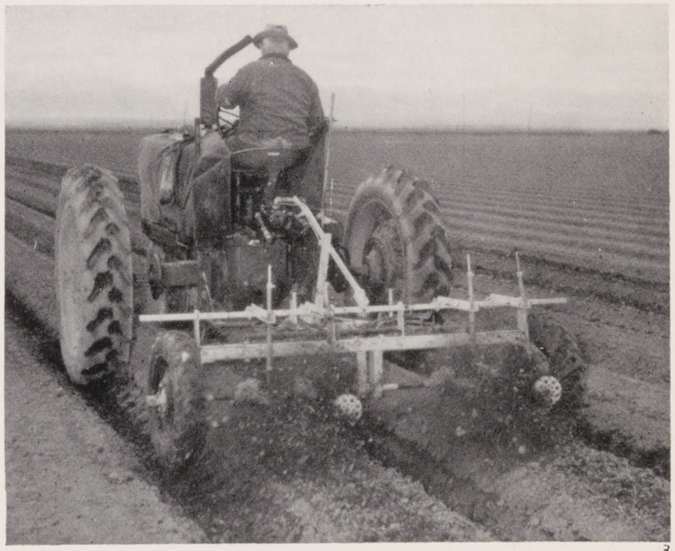
ARROW (upper left) points to the 9 tooth RC 50 sprocket which Jerry Fielder installed to double the countershaft speed of his John Deere #66 planter.

The stand was very good by ordinary standards, but would have been somewhat better for mechanical thinning if the higher planting rate had been used throughout.

Thinning was accomplished by three passes of the thinning machine—the first with eight arm cutters set to cut 1½ inches and leave blocks on 3½ inch centers; the second with sixteen arm cutters set to cut ½ inch, and the third a repetition of the second in some areas of the field judged to be too thickly populated.



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DOWN-ROW thinners were used on both the Fielder and Tadlock fields. Mr. Fielder used a Dixie, while a Silver (above) was used on the Tadlock field.

No hand work was used, either long or short-handled hoe, but when the entire field was ready for weeding, a long-handled hoe crew went straight across the field, treating the hand and mechanically thinned strips exactly the same.

All cultural operations (fertilizing, cultivating, and irrigating) were the same throughout the forty acre area. At harvest time careful records were kept of total tons harvested from each strip, together with sugar percentages for each load. The harvest was interrupted by rain when the second replication was partly finished, so the results of the first replication are here presented:

	HAND	MACHINE
Tons Beets Per Acre	22.88	22.87
Percent Sugar	13.99	14.09
Pounds Sugar Per Acre	6390	6446
Thinning Cost, Per Acre	$21.80	$8.96

These results are striking—the tonnage was the same for both methods; the sugar percentage a trifle higher for machine thinning (not statistically significant); and the cost saving a neat $12.84 per acre.

THE TADLOCK EXPERIMENT

This experiment was designed to determine the tonnage yields and sugar percentages in beets which were mechanically thinned under realistic field conditions. The field had been planted with the combination lister-bed shaper-planter which Mr. Tadlock designed and built. The beds were level; the stand fairly uniform, but the soil quite cloddy and hardly ideal for mechanical thinning. In this case a Silver thinner was used, but no fixed sequence of cutter head changes was observed. The stand was much thicker in certain areas than in others, and the choice of cutter head (spring tine weeder, eight arm cutter with 1½ inch hoes, or sixteen arm cutter with ½ inch hoes) was determined by appraising the stand in the areas worked. In this way an attempt was made to leave 150 hills per 100 feet of row. The actual stand counts ranged from 152 hills down to 98 hills—with an average of 118.5. Thus was demonstrated the need for a heavy, uniform pre-thinning stand, to avoid frequent big gaps, and to allow for loss of some beets before harvest time.

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GOOD SEEDBEDS, with straight rows and uniform shoulders, resulted from using Mr. Tadlock's lister-bedshaper-planter combination.

Eight replications, each consisting of two rows, 1600 feet long, were made. Hand thinned strips, two beds wide, alternated with the mechanically thinned strips. Hand thinning was by short-handled hoe, and no special instructions were given to the crew other than to treat these tested strips exactly the same as several hundred acres of commercial fields in which this crew had operated.

Weed growth was heavy in all of the plots, but after normal cultivation and a single hoeing operation it was not possible to distinguish the hand and mechanically thinned strips.

The plots were harvested with a two row Marbeet Harvester and records kept on total tonnage for each plot along with sugar percentages for each plot. The results (average of eight replications) are tabulated below:

	HAND	MACHINE
Beets Per 100 feet of Row	93.1	86.3
Tons Beets Per Acre	19.19	18.24
Percent Sugar	15.09	15.16
Pounds Sugar Per Acre	5800	5526

Statistical analysis of these results reveals no significant difference in tons per acre, sugar percentage, or sugar per acre. However, the average sugar per acre from the mechanically thinned strips was 5526 pounds as compared to 5800 pounds from the hand thinned strips. Even though this difference is not statistically significant, let us assume that the difference of 274 pounds of sugar per acre was a true measure of the difference between hand and mechanical thinning. At 15% sugar this represents a yield reduction of .9 ton per acre as a result of mechanical thinning, or a penalty of $11.00 per acre.

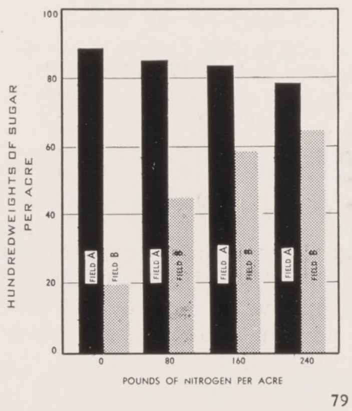
Offsetting this hypothetical yield reduction, there is the very real saving in thinning labor. It is impossible to generalize on the cost of hand thinning an acre of beets, because the rates vary so greatly between different areas. But $11.00 per acre is less than the contract cost of hand thinning, except under most unusual circumstances. Of course, machine thinning is not free of cost either. Driving a wheel tractor over a field twice with a four row machine costs in the neighborhood of $5.00 per acre. Thus, the real cost of mechanical thinning (direct labor, depreciation, and possible reduction of yield) can be compared to the real cost of hand labor (direct labor, contractors' bonus, camp expenses, etc.). Examination of this comparison will point to a substantial dollar saving attributable to machine thinning, along with relief from the dependence on an unreliable labor supply.

It must be stressed that this cost analysis has been based upon a most conservative—in fact pessimistic-interpretation of the experimental results, and that these results must inevitably point out the fact that mechanical thinning can, in most cases, result in a real dollar-per-acre saving, and in all cases can eliminate the many problems attendant upon maintaining a crew of hand workers.

A CORRECTION

In the article "ARE YOUR BEETS WELL FERTILIZED" in the November-December issue, there occurred an error in captioning the vertical scales of the bar charts on page 44.

The charts should appear as shown below:



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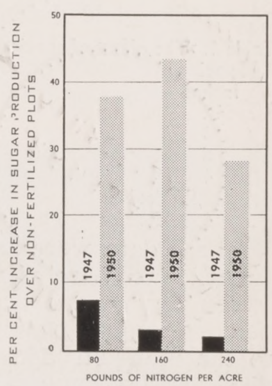
LEFT—the nitrogen requirement for sugar beets differs markedly from field to field. Nitrogen added to field A actually depressed yield, while the net dollar return continued to increase when 240 lbs. of N per acre were applied to field B.



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RIGHT—nitrogen requirements for the same field differ from year to year.

YIELDS AND HARVEST STANDS FROM VARIOUS SEEDLING SPACINGS

By DAVID RIRIE
Junior Agronomist, University of California

As a farmboy I recall how disturbed my father and uncle used to be when they walked over their beet fields after thinning and observed that the crew had left doubles or had done an uneven job of spacing. Their attitude was typical of farmers in their area. It is also true today that many of our farmers take great pride in seeing their fields thinned to a beautiful evenly spaced stand of singles. The advent of thinning machines has been accepted with varying degrees of enthusiasm in the beet-growing areas of the United States. In the mid-west where farm labor is more often in short supply, machine thinning has developed rapidly, which is in contrast to its rather cool reception in California. Perhaps preconceived notions on the part of farmers, that the stand should be of a certain spacing and that no doubles should be allowed to remain, has been partly responsible for the slow progress of spring mechanization.

It is true that the machines in most common use leave doubles and clumps along with the singles. Skips are inevitably lengthened in some cases by these same machines. Growers have asked, "How much will doubles effect the yield?" and, "May the effect of skips be compensated for by leaving higher populations?"

In the hope of answering these questions, an experiment was conducted at Davis in which sugar beets were hand thinned to singles spaced at 12, 8, 6, and 4 inches, Plots were 60 feet long, and covered four rows, of which the center two were harvested. All plots were replicated six times. Plots were also included at spacings of 12 and 6 inches in which fifty per cent of the hills were thinned to doubles. All of the replicated plots were handled exactly the same with respect to fertilization, irrigation, and cultivation. At harvest time the following data were taken: stand count, yield, per cent sucrose, and sugar per acre. The yield data are summarized in Table 1.

Table 1. The effect of spacing and doubles on yield.

Spacing Inches	Per Cent Sugar	Yield (Tons Per Acre) Roots	Sugar
12	16.5	22.9	3.77
8	16.6	23.4	3.89
6	16.4	23.9	3.93
4	16.8	23.9	4.01
12, ½ doubles	16.7	23.0	3.83
6, ½ doubles	16.5	23.0	3.79

These data were analyzed statistically and it was found that there was no significant difference between any of the treatments with regard to yield, per cent sugar, or sugar per acre. Thus the answer to the question "How much will doubles affect the yield" is "not enough to be significant."

A comparison of the thinned stand with that at harvest time revealed that at the higher stands the populations tended to drop with the passing of time after thinning. This tendency was more pronounced

Continued on page 8

ARE SINGLE BEETS NECESSARY?

By LAUREN BURTCH
Assistant Plant Breeder, Spreckels Sugar Company

It is generally accepted that mechanically thinned stands are irregular stands consisting of a number of clumps and double beets with a relatively small number of single beets. In spite of the initial irregularity of these stands, however, sugar per acre yields from mechanically thinned fields have not been reduced as much as the appearance of the stand immediately after thinning would indicate.

The results of two experiments established in commercially thinned fields in the Davis-Dixon area last summer indicate that there are two main reasons for the maintenance of yields from mechanically thinned fields. These reasons are:

(1) Clumps tend to reduce to doubles and singles as the growing season advances.

(2) Two or even three small beets growing in the same space as one large beet tend to equal the sugar yield of the single large beet under adequate moisture and fertility conditions.

Both of the fields selected for this experiment were located in the Davis-Dixon area on 30 inch single-row-beds. In each field, four one-hundred foot lengths were staked and all of the hills in each section were classified and counted periodically as multiples, doubles and singles. The first counts were made just after thinning and continued until just before harvest. The results of the first and last counts are shown in figure 1. It can be readily seen from these charts that the stands just after thinning contained from 47% to 63% multiples, and only approximately 30% singles. By August, the singles in every case had increased to nearly 50% of the total remaining, while the multiples were decreasing in about the same proportion.

As the season advanced, many of the beets in the double and multiple group developed in size to the point that at last counting date, it was difficult to distinguish between singles and multiples. Because of the development of these beets, it was decided to select samples in areas where the beets were severely crowded to compare with the other extreme—the large beets spaced at intervals of 12 inches. A comparison of the two conditions is shown in figures 2 and 3.

In each field, five foot sections of row were selected where the beets were very close (more than 3 beets per 12 inches) and the yields compared with the yields from 5 nearby beets, each spaced at 12 inches. Twelve comparisons were made in the C. Bruce Mace Ranch at Davis, while ten comparisons were made in Jerry Fielder's field at Dixon. The yields shown in Table 1 are synthetic to the extent that no skips or long gaps were included in the samples. Although these yields as reported do not represent the field average, they do represent the potential yield that could be expected from each field had it contained as many beets on the average as the areas sampled.

It should be pointed out at this point that both of

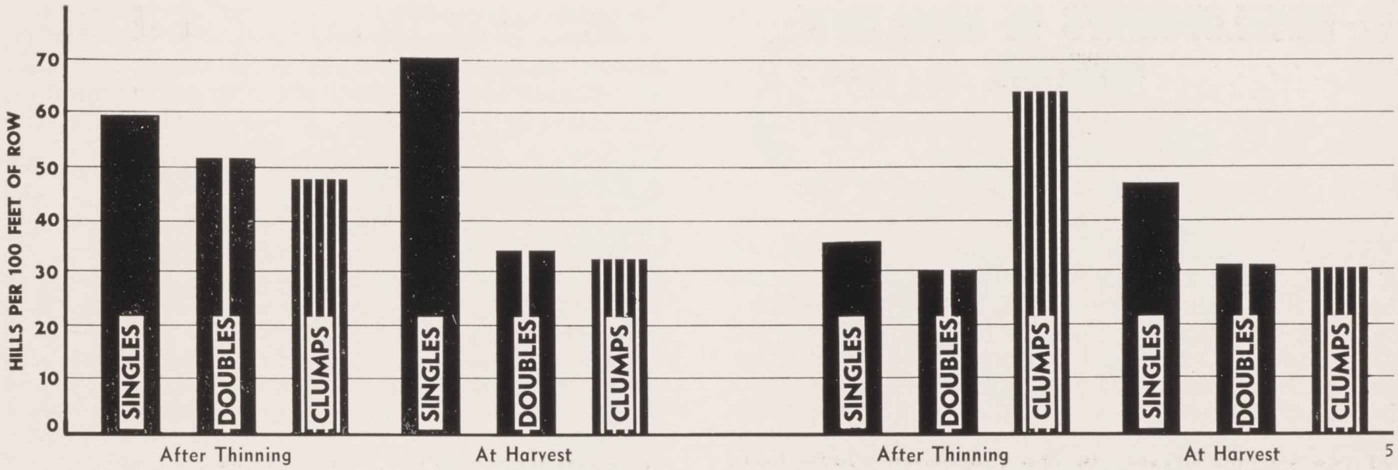

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Figure 1. LEFT—Mechanically thinned beets. RIGHT—Hand thinned beets. In both cases, the clumps showed a remarkable tendency to reduce to singles or doubles, while the number of single beets increased sharply.

these fields received good care. The Mace Ranch field at Davis was planted in late April, received 88 units of nitrogen and frequent irrigation (water was running nearly continuously on some portion of this field all summer) and all beets, whether spaced or close in the row, grew well as is evidenced by the 4 pound average weight of beets spaced at 12 inches.

The Fielder field at Dixon also received good cultural care, with ample fertilization and irrigations. This field averaged 23 tons per acre.

Table 1 shows that 3½ to 4 pound beets were produced in each field at the 12 inch spacing, while the close spacing produced beets averaging only a little more than one pound; but more than three of these one-pound beets were produced in the same length of row as the single four-pound beet. The total tonnage produced favored the wide spacing in each case by a small margin which was offset in the Mace Ranch field by a higher sugar percentage. The Fielder field favored the wide spacing by only .2 of a ton of sugar per acre (400 pounds), showing that in no case were the yields reduced to any extent by the high population of beets.

Table 1. Yields from selected areas as influenced by the harvestable stand of beets.

Grower	Spacing	Ave. No. Beets Per Ft.	Ave. Wt. Per Beet (lbs.)	Ave. Wt. Per Ft. Row (lbs.)	Sugar (%)	Beets Per Acre (tons)	Sugar Per Acre (tons)
Mace Ranch, Davis	Close	3.4	1.09	3.74	15.8	32.6	5.15
	Wide	1.0	4.00	4.00	14.9	34.8	5.18
Fielder Ranch, Dixon	Close	3.2	1.13	3.58	12.9	31.2	4.02
	Wide	1.0	3.66	3.66	13.2	31.9	4.21

It should be pointed out that all the data reported were taken from fields planted to single rows 30 inches apart, and therefore might not apply so well to the 40 inch double row beds used in many California beet growing areas.

Actually, neither of the stand densities reported represents ideal thinning. But these irregular stands do occur when either the mechanical thinner or long-handled hoe are used. The results from these fields indicate that neither extreme of stand depresses yields to any extent, and that the mechanical thinning operation should be directed less toward leaving individual beets and more toward leaving a uniform stand of beets with a minimum of skips and gaps longer than 12 inches. When this policy is observed, mechanical thinned beets will not only yield as well as hand thinned, but the full advantage of in-row weed control can be realized, because there will be more beet plants to compete with weeds for moisture, nutrients and sunshine.

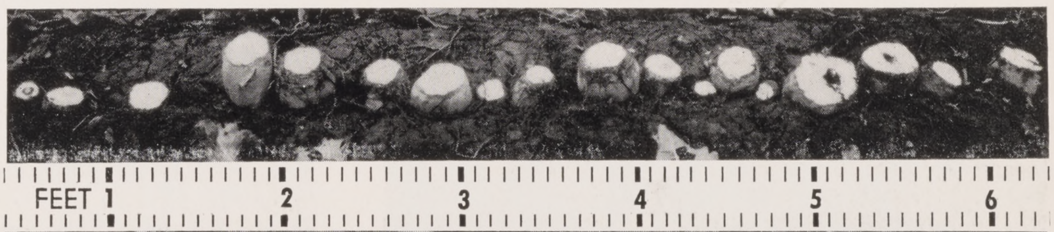

Figure 2. These beets averaged 3.4 per foot and 1.09 pounds in weight.

Figure 3. These beets averaged 1.0 per foot and 4.00 pounds in weight.

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DEVELOPMENTS IN NEMATODE CONTROL

By G. D. MANUEL, *Vice President and General Agriculturist Spreckels Sugar Company*

FOR A NUMBER of years we have been aware of the damage to sugar beet crops caused by nematodes, both the rootknot and the sugar beet nematode. Rotation has been the only general remedy, and records kept on individual fields have indicated that serious losses did not usually result when sugar beets were the only susceptible crop in a long rotation. This method of living with the nematode has not been entirely successful, however, as the infestations have spread and in some cases the beet crops have been damaged even after a lengthy rotation between susceptible crops.

There are several explanations for losing ground to the advances of nematodes. One, and we believe an important one, is the moving of farm equipment from farm to farm and district to district. Mechanical harvesters certainly can be pointed out as guilty parties in spreading nematode populations. Another factor in developing greater nematode populations has been better cultural practices in raising the crop. This may sound rather odd, but a beet crop that is given excellent care can tolerate a small nematode population and grow vigorously to make a good yield. However, in making this high yield it is lending itself to an ideal situation for the build-up of high nematode populations, because of the beets' extensive root system. The nematode life cycle is so fast that additional numbers will be built up during the season the beet crop is growing, and although the growing crop shows little damage, the nematode population becomes so high that a failure can be experienced three or four years hence when another beet crop is planted.

Because this problem of nematodes is critical in many of the beet growing areas of the United States and the work that has been done has not been too productive of results, a meeting was held in Denver, Colorado, in January of this year to discuss all phases of the problem. The meeting was sponsored by the Beet Sugar Development Foundation. Present at the meeting were representatives from federal and state experiment stations, chemical company research men, and the scientists of the sugar beet processors.

Phil Smith Photo 7

THE DISCUSSION panel on Nematode, Beet Sugar Development Foundation. Left to right: G. D. Manuel, president of the Foundation; Dr. Helen Savitski, USDA; Dr. Gerald Thorne, USDA; Dr. C. W. McBeth, Shell Chemical Co.; Dr. D. J. Raski, University of California; Dr. J. F. Kagy, Dow Chemical Co.

Reviews of the work done to date were presented and the possible approaches to additional work and new phases were also discussed. In brief summary, the following were some of the highlights of the meeting.

SOIL FUMIGATION, which has been discussed many times in previous Sugar Beet Bulletins, was thoroughly reviewed. Its use must still be confined to light soils and the results, while improving with better methods of application, are in many instances uneconomical. This does not mean that hope has been given up for this method of control. The chemical industry is doing an outstanding job in testing new materials and their behavior in soils and to give up on this approach would be most short-sighted.

CROP ROTATION. This topic also is an old one and has not changed a great deal, but is still the only practical approach at this time. Some interesting developments on trap crops were discussed, in which the nematode can be hatched and then starved to death before completing a life cycle to establish another brood. This approach is being given serious consideration and will be followed closely by the industry.

RESISTANT BEET VARIETIES. Here, there is great hope in an almost unexplored field. With success shown in resistant varieties of tomatoes and beans, it is felt that sugar beets may have a real chance in this line of research. This is especially true with the knowledge that certain wild species of the beet are known to be resistant to sugar beet nematode. The work involved in getting such resistance into a commercial beet variety is tremendous, but the beet industry will do all it can to aid and encourage plant breeders in this approach.

OTHER POSSIBILITIES were also discussed. One of the most interesting approaches is suggested from observations in hatching nematode cysts for laboratory work. Placing a young beet in a flask with nematode cysts brought about rapid germination of the cysts, while a flask without any beet root present had no germination of the cysts. This has lead to the thought that some substance in the beet root may be necessary for germination of the cyst. If the substance can be isolated, it possibly could be applied to nematode infested ground to stimulate germination of the cysts, the larvae of which would soon starve to death if a susceptible host plant were not present; or plant breeders can possibly select beets with a lack of this substance or at least less of it present, so that cysts are not as apt to germinate and attack the root system.

All of these various phases of the nematode research will be pushed forward as fast as possible. The beet sugar industry through this conference has been able to ascertain how it can best help in aiding the scientists, and the industry pledged its wholehearted support. Also, it is hoped that closer cooperation between various phases of the research work can be accomplished.

The Spreckels Sugar Company has set aside acreage at both Spreckels and Woodland Experimental farms for nematode research as part of its contribu-

tion toward this program. Here, both public and private research agencies can have plots, which will be kept up by the company. Through such field work it is felt much time can be saved in the ultimate solution to this very serious problem.

SAFE TRANSPORTATION OF WORKERS

Reprinted from Bulletin 114
Division of Industrial Safety, Department of Industrial Relations, State of California

TOO MANY California workers are killed or severely injured while being carried to or from work. The figures are shocking.

In agriculture alone in 1950, for instance, there were 121 workers disabled, 14 workers killed, while being carried to or from their jobs. To reduce these unnecessary deaths and injuries, the State of California set up safety standards for trucks that are used to haul workers. According to the law, such trucks must conform to these safety standards. If at any time your truck is used mainly for carrying workers, you must follow certain rules.

A SEAT FOR EVERYONE!

There must be a seat for everyone. And seats must be strong and firmly secured. Such things as loose planks, boxes and barrels are not acceptable as seats. All seats at the sides or end of truck, or across the width of the truck, must have back rests that are properly secured in place. If sides and end gates of stake body trucks are in good condition and firmly in place, they are acceptable as back rests. To avoid crowding, allow at least 18 inches seating space per person.

ENCLOSE THE SEATING AREA

If you have a stake body truck, you must see that the sides and end gates are well built and kept in good condition. They should be at least 42 inches high. If you have a pickup, you may use the back rests as an enclosure, but only if the top of the back rests is at least 36 inches above the pickup bed. The rear of the pickup must be blocked off by chains, cables or straps to a height of at least 42 inches above the bed. Tail gates and end gates must be up and properly secured in place before trucks move.

BUS-TYPE TRUCKS

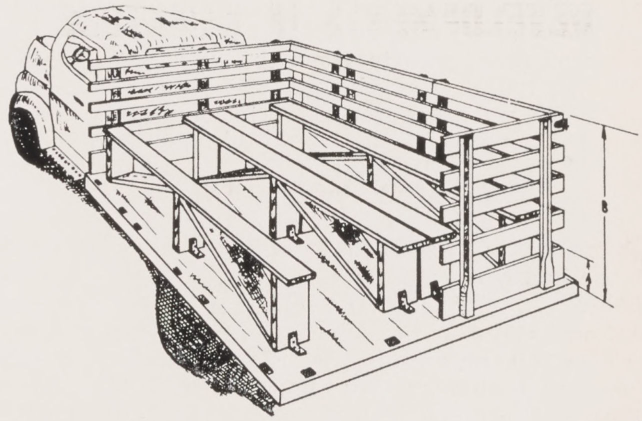
If you have a bus-type truck that is not canvas covered or loaded from the rear, it must have an emergency exit, which should be at least 24 inches wide. The inside of this emergency exit must be clearly marked "Emergency Door." Any heater used in a bus-type truck must be of a type approved by the Division of Industrial Safety.

PROVIDE A SAFE WAY OF GETTING ON AND OFF TRUCKS

With a stake body truck, the end gate may be used as a ladder. But it is better to carry a portable ladder at all times, or to provide permanent steps and metal handholds at the rear. With a pickup truck, try to provide metal rungs and metal handholds at the rear.

TRUCKS USED OCCASIONALLY FOR CARRYING WORKERS

If your truck is only occasionally used for carry-



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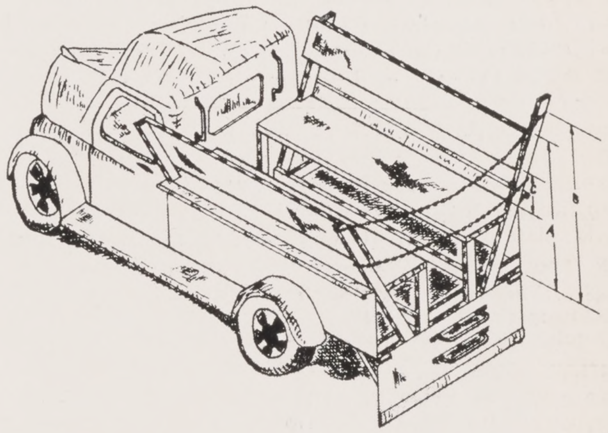
STAKE BODY truck with seats lengthwise along the sides and middle of the truck. The side and end gates, part of which are shown, are acceptable as back rests if well built, in good condition, and firmly anchored. The bottom board, which should be flush with the bed of the truck, should be at least 8 inches high (Height A). The distance B should be at least 42 inches. Note how well the benches are braced and secured.



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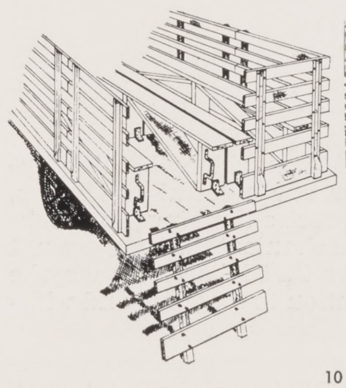
A PICKUP with seats. The top of the back rest should be at least 36 inches above the bed. (Distance A). The upper chain at the rear should be at least 42 inches above the bed. (Distance B). The opening between the top of the seat and the bottom of the back rest should be not more than 18 inches. (Distance C). Note the metal rungs at the rear and the handholds behind the cab.



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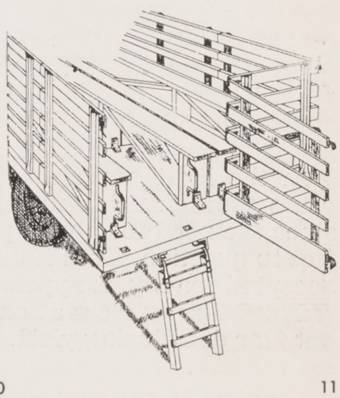
TRUCK with tail gate for getting on and off the truck. This method is acceptable, but permanent steps or a portable ladder is preferred.



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TRUCK with portable ladder. When the ladder is not in use, it is carried under the truck bed on the channel iron supports.

ing workers (and is mainly used for other purposes), here are some rules that must be followed: Workers must ride in the cab, whenever possible. Flat-bed trucks must be protected on the end and sides. Pickup tail gates must be closed, or similar protection provided, and workers must sit on the truck bed or on temporary seats that are securely fastened. If these rules are not followed, not more than two workers may ride on a truck bed, and they must hold on to suitable grab irons rigidly fastened to the truck.

IN ALL CASES

Never allow workers to ride on the top of a cab or side rail, on running boards, on fenders, on the hood, or with their legs hanging over the end or sides of the truck bed. Make sure that drivers are licensed to operate the trucks, that they know and obey the Vehicle Code, and that they do not drive too fast. See that brakes are checked frequently, and that trucks are kept in good operating condition.

Rules for the safe transportation of workers are included in the General Industry Safety Orders, which can be obtained from the Documents Section, Printing Division, 11th and O Streets, Sacramento 14, for 77 cents a copy, including tax and postage.

YIELDS AND HARVEST STANDS

Continued from page 4

as the population increased. It was even more pronounced at comparable stands, where doubles were left. Reference to Table 2 will show this trend.

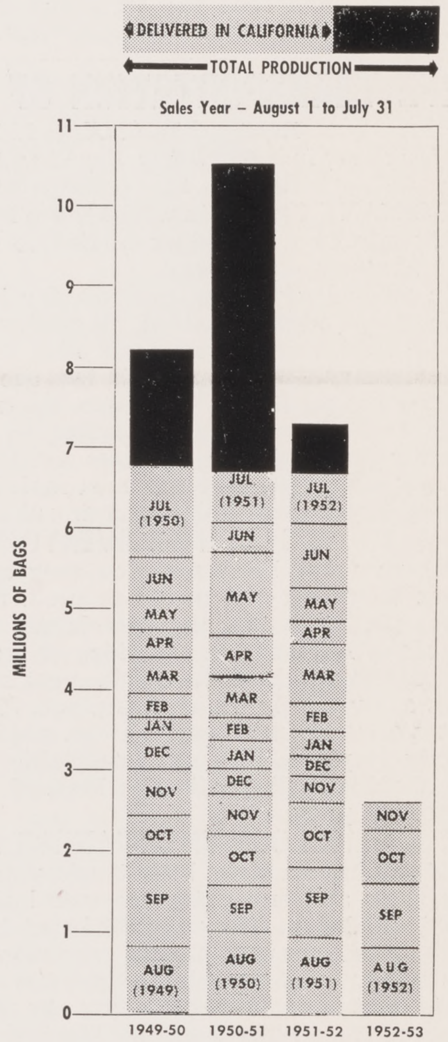
Table 2. Variation in harvested stands following thinning to differing spacings.

Spacing Inches	Stand Per 100 Foot of Row At Thinning	At Harvest	Change in Stand	Per Cent Change
12	100	102	+ 2	+ 2
8	150	145	— 5	— 3
6	200	175	— 25	—13
4	300	184	—116	—39
12, ½ doubles	150	139	— 11	— 7
6, ½ doubles	300	176	—124	—41

The results of this test indicate that spacing can vary over a wide range at higher population levels without changing the sugar per acre yield significantly. Under the conditions of this experiment, as high as fifty per cent doubles had no detrimental influence on yield. The decline in individual beet root size was overcome by the increased number of roots at spacings as close as three inches. Closely spaced beets, whether singles or doubles, tended to approach wider spacings because of an inverse relation between mortality rate and spacing.

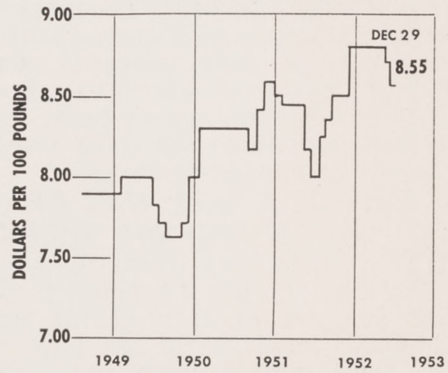
In the light of these data machine thinning appears more feasible under our cultural conditions, since the need for a very precise thinning job is subject to question. Even if mechanical thinners are not accepted readily, it appears that labor costs may be reduced through less attention to singling, and without fear of reducing yield.

PRODUCTION AND DELIVERIES OF BEET SUGAR IN CALIFORNIA



QUOTED PRICE OF BEET GRANULATED SUGAR

In 100 Lb. Paper Bags, F.O.B. San Francisco



The SPRECKELS SUGAR BEET BULLETIN is issued bi-monthly by the Agricultural Department of the Spreckels Sugar Company as a service to its growers.
Mention of specific methods, devices or implements does not constitute an endorsement by the Company.
All photographs by the editor unless otherwise indicated.
AUSTIN ARMER, Editor 600 California Fruit Building Sacramento 14, California

SPRECKELS SUGAR BEET BULLETIN

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COMING EVENTS CAST THEIR SHADOWS BEFORE

And machine thinning is a coming event for 1953

California beet growers will

REDUCE LABOR REQUIREMENTS

REDUCE PRODUCTION COSTS

PRODUCE HIGH YIELDS

Vol. 17 MARCH - APRIL, 1953 No. 2

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

MACHINE THINNING—ITS HISTORY, PRESENT STATUS AND APPLICATION

By AUSTIN ARMER

Agricultural Engineer, Spreckels Sugar Company

CALIFORNIA sugar beet growers are interested in machine thinning—their talks with sugar company men and their orders for machines leave no doubt of the fact. But the subject is new in California, and a general discussion of several aspects seems to be in order.

HISTORICAL BACKGROUND OF SPRING MECHANIZATION

One of the most important steps forward in the concept of mechanical sugar beet thinning was the theory set forth by E. M. Mervine of the U.S.D.A. in the 1930's. This theory—or rather a philosophy—of mechanical thinning of sugar beets was based on the concept that a job of thinning was essentially a reduction of plant population in which the final stand was a certain percentage of the pre-thinning stand. Thus, if the pre-thinning stand contained five times as many plants as the desired thinned stand, the Mervine theory proposed a random reduction of this stand to 20%, with little regard for spacing. The problem of spacing was left to probability, and according to the laws of probability, the approach to uniform spacing would be within tolerable limits. In the light of present methods, Mr. Mervine's statement of 1942, in a paper presented to the American Society of Sugar Beet Technologists, seems prophetic.

> "The objective in mechanical thinning is to leave as small blocks as practical, thus obtaining a large percentage of blocks containing single seedlings and at the same time leaving the remaining plants close enough together so that in spite of the blank spaces resulting from blocking and those left by subsequent removal of bunched plants, enough beet seedlings would remain to give a good yield."

Concurrent with the work of Mr. Mervine was the attempt to press into service the Dixie Cotton Chopper—a device having some acceptance for thinning cotton plants and which was purchased in considerable numbers at the outbreak of World War Two. Acceptance of these earlier Dixie beet thinners by beet growers was poor because they were blockers rather than thinners, and only partially met the conditions set forth by Mr. Mervine's theory of thinning.

After the war, the Great Western Sugar Company initiated a program of mechanical thinning, but by this time the Dixie cotton chopper manufacturers had ceased to be a factor in the business, and the task of designing and building a rugged down the row stand reducing machine was assigned to the Silver Engineering Works, Inc., of Denver.

Following the designs and requirements laid down by the Great Western Sugar Company, the Silver Engineering Works brought out a machine having a variety of cutter heads which accomplished stand reduction with a wide choice of block spacings ranging from two to eight inches, and with a wide variety of cutters, adaptable to various soil conditions.

Meanwhile, the Dixie machine had ben revived and a very complete offering of down the row thinning machines was designed and put into production by the Dixie Implement Manufacturing Company.

IMPROVED BEET THINNING MACHINES NOW IN PRODUCTION

The two present leading manufacturers of beet thinning machinery, the Silver Engineering works at Denver and the Dixie Implement Manufacturing Company at Dallas, are providing their many dealers with improved versions of their beet thinners.

The new models of both manufacturers have the tractor-mounted feature, making the thinner an integral part of the tractor. This means time saved on turns, higher speed in the field, and accurate on-row driving. Both manufacturers provide individual gage wheels to control cutter depth on each row, and all models have staggered cutter heads permitting adjustment to all row spacing from 12 to 30 inches.

The Silver thinners for 1953 have been equipped with tapered roller bearings and positive grease seals on every moving shaft. They retain the 3 to 1 gear ratio, with two ground wheels and axles to provide a differential effect on turns.

The 1953 Dixie thinners have permanently lubricated bearings on all shafts, and their gear boxes have a 2 to 1 ratio. This gives a slower cutter speed which is compensated by employing ten and twenty arm cutters instead of the eight and sixteen arm cutters used with higher cutter speeds. The tractor-mounted unit has a single ground wheel at the center of the drive shaft, while the trailed models with two ground wheels have pin clutches to disengage the drive mechanism when the machine is trailed down the highway at high speed.

It would appear that the acceptance of these two machines increased tremendously in 1952—to the extent that the tractor-mounted units, designed for individual grower ownership, are replacing the trailed units, which were necessary during the introductory phase, when the sugar companies offered the machines to growers on a rental basis. Further evidence of the acceptance of mechanical thinning is offered by the large number of implement dealers throughout California's beet growing areas who now offer their customers sales and service facilities for these aids to sugar beet mechanization.

ORGANIZING A MACHINE THINNING PROGRAM

A thinning machine about to enter a beet field is no more capable of producing a perfect stand of beets than is a crew of willing workers who never saw a beet field before. Either can do a satisfactory job only if properly supervised and intelligently directed.

Because no two fields are alike in stand or soil condition, it is impossible to set up a rigid formula or set of instructions for getting the best job out of a mechanical thinner. Only the generalized overall rules for operation can be set down, and their interpretation and application to a particular field must be left to the grower's judgment. So a few general rules are presented below, stated as a tabulation of DO's and DON'T's.

DO everything possible to insure a good, solid seedling stand. Plant heavily into a fine seedbed and irrigate up if necessary.

DO the best possible job of mechanical weed control before thinning. Cultivate close to the row and return soil to the row so as to prevent leaving a high "core" in the row.

DO schedule thinning (hand or mechanical) early—2 to 4 true leaves.

DO plan a machine program to be followed by long handled hoe crew at time of first weeding.

DO classify the stand into:

1. **Heavy** (solid green row—no gaps over 6 inches).
2. **Medium** (broken green row—gaps up to 10 inches every few feet).
3. **Light** (completely broken row—gaps from 10 to 15 inches more frequent than continuous plants).

DO operate the thinning machine according to the stand estimate.

1. **Heavy stand—Once** over with 8-1½″ cutters, **again** with 16-⅝″ cutters, and **perhaps** again with 16-⅝″ cutters.
2. **Medium stand—Once** over with 8-1½″ cutter, and **perhaps** again with 16-⅝″ cutters.
3. **Light stand—**Leave it alone. Don't use a machine—get a long handled hoe crew **before** beets have 6-8 true leaves and weeds are 4 to 6 inches high.

DO wait about 2 days after each pass of the thinning machine to re-estimate the stand before again using the machine.

DO always drive the machine in the **opposite** direction from its previous pass.

DO use the spring-finger weeder head in light or sandy soil when the stand is thick or full of very small weeds.

DO drive fairly fast (3 to 5 miles per hour).

DO stay on the row as accurately as if cultivating.

DON'T expect to rescue a field with a thinning machine that has grown past the possibility of hand thinning.

DON'T even contemplate machine thinning if the stand is **light** as described above.

DON'T ruin a medium or heavy stand by too many passes of the machine.

DON'T **EVER** go over the same field a second time with the 8-1½″ cutter. This will take out nearly all the plants.

DON'T drive a thinning machine twice in the same direction.

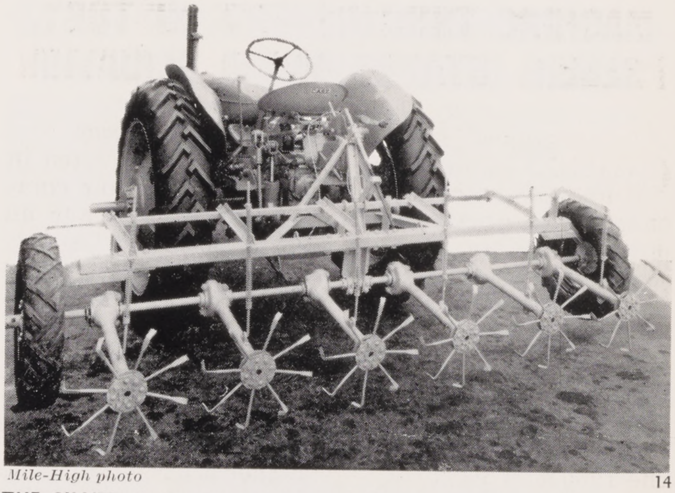
DON'T use a spring finger weeder head in hard, cloddy soil.

DON'T cultivate with discs set to throw soil away from row and leave a high core.

DON'T expect machine thinning to leave a single plant every 8 inches.

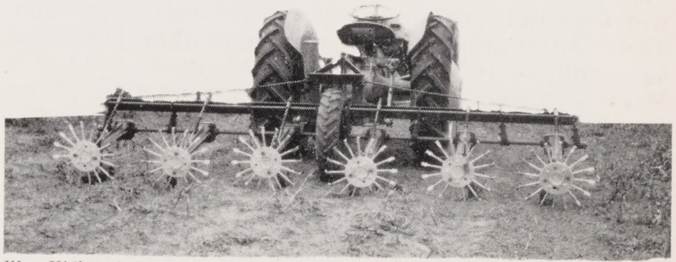
DON'T worry about doubles, (up to 50% of all hills) or a few clumps (up to 25% of all hills).

DON'T forget that a thinning machine can do a good job only if followed up with a long-handled hoe crew at weeding time.



Mile-High photo 14

THE SILVER six-row tractor-mounted thinner—may be purchased as a trailed-type machine for four or six rows.



Wm. Vidler photo 15

THE DIXIE six-row tractor-mounted thinner—available also for four rows, and in a trailed-type model.

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ESTIMATING the stand before thinning and properly classifying it as Heavy, Medium or Light is a critical step in machine thinning.

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HOEING, to control weeds and remove excess clumps of beets, follows machine thinning at the regular time for the normal first hoeing.

A PROGRESS REPORT ON THE SUGAR BEET BREEDING PROGRAM

By DR. RUSSELL T. JOHNSON
Plant Breeder, Spreckels Sugar Company

IN PLANT breeding, as with most other types of research, there are always problems yet to be solved and no sooner is one problem worked out than there are others to take its place. Some twenty-five years ago curly top, a virus disease transmitted by a leaf hopper, threatened the survival of the sugar beet industry in the western states. Today, after considerable expenditure of time and money, we have varieties available which are resistant to this disease. The use of resistant seed, supplemented by a spray program to control the population of leaf hoppers, has made possible the production of satisfactory crops of beets in areas which were formerly thought unsatisfactory for sugar beet production.

With the curly-top problem out of the way, more attention is being given to other problems. One is the control of sugar beet nematode. This is not a new pest, but has been known for a long time. Unfortunately, more and more land is becoming infested with it. The interest being shown in this problem was recently demonstrated when an industry wide meeting was held just for a discussion of possibilities for control of this pest. An article in the last Bulletin by Mr. Guy D. Manuel described the overall discussion in that meeting. This article will discuss the possibility of developing a sugar beet resistant to attack by the sugar beet nematode.

NEMATODE RESISTANCE

Three wild species of the genus to which the sugar beet belongs have been shown to be almost, if not completely, immune to attack by nematode. These three species are native to the Canary Islands in the eastern Atlantic Ocean, the south coast of Spain and Morocco. These species resemble the sugar beet only for a short time during their growth. They emerge with two cotyledons similar to a sugar beet, but instead of developing a large root, they immediately begin to form a seed stalk, and begin producing flowers when the tops are only four to eight inches high. They are semi-tropical plants and are killed with even the slightest frost. Thus it can be seen that these plants are of little commercial value as they are. However, they do provide a source of resistance to the nematode, and if that character could be transferred to a desirable sugar beet variety, it would indeed constitute a tremendous benefit to sugar beet agriculture. A few workers have attempted to cross these wild species with sugar beets but results have not been successful. Seed was produced, but most seedlings grown from such seed lived only a short while and then died. It is hoped that experiments on a wider scale with these crosses will lead to success in getting the hybrids to grow. Sugar beet breeders in areas where the nematode is a problem are taking a great interest in this approach to solving the nematode problem. We are now attempting some of these crosses in the greenhouse between sugar beets and each of these three species.

MONOGERM SEED

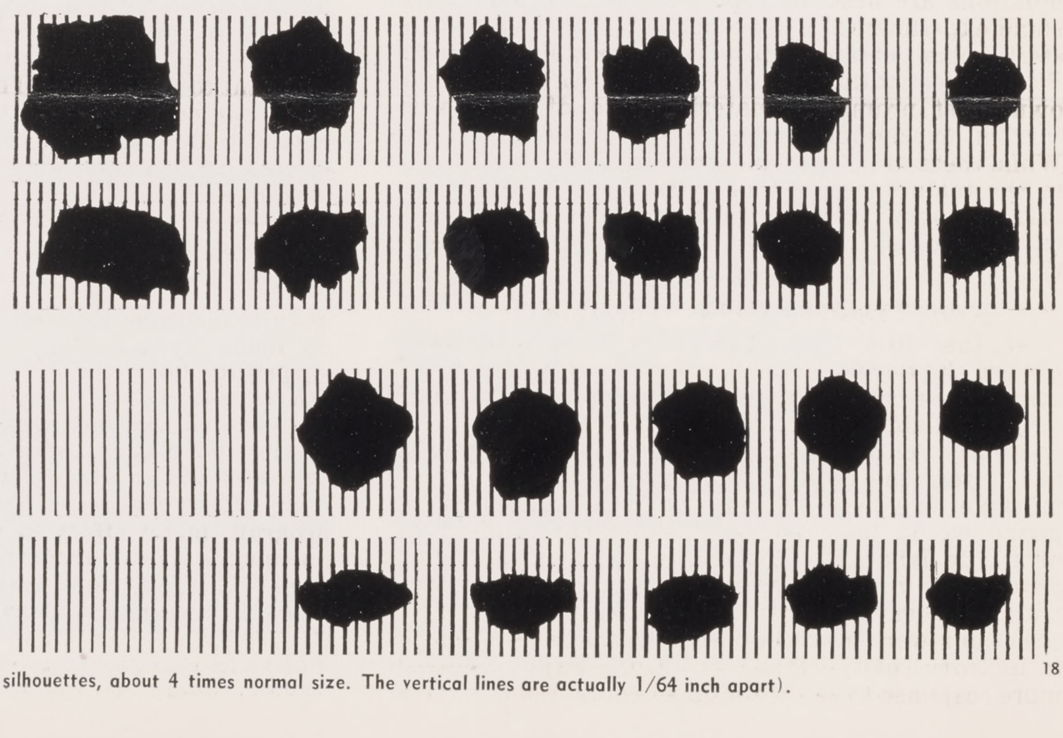
Our program for the development of varieties of sugar beets with monogerm seed is gradually progressing. We now have several strains of beets which are breeding true for the monogerm character, and in addition, possess many desirable traits of good sugar beets. This is considerable improvement from the original monogerm plants which were obtained. The original monogerm plants were discovered in a seed field in Oregon by Dr. V. F. Savitsky working under

TOP VIEW of recleaned monogerm seed — 6 to 12/64 inch screen fractions.

SIDE VIEW of the same seeds, showing the tendency toward flatness.

TOP VIEW of decorticated monogerm seed — 6 to 12/64 inch screen fractions.

SIDE VIEW of the same seeds — the flat characteristic is increased by decorticating.



(These are actual photographic silhouettes, about 4 times normal size. The vertical lines are actually 1/64 inch apart).

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the direction of the U. S. Department of Agriculture. Two plants of this material were supplied to interested sugar-beet breeders throughout the country. These original monogerm beets were weak in vigor and possessed resistance to none of the diseases common to sugar beets in California, but they did breed true for the monogerm character. The most valued attribute of monogerm seeds is that they could produce a stand of beets ideally suited to mechanical thinning. It should be pointed out, however, that both uniform distribution and a high emergence are essential if the potential advantages of monogerm seed are to be realized. If the seed is not distributed singly and uniformly down the row, but three or four seeds dropped in one spot, no advantages will be gained over our present multigerm varieties. Also, if emergence is not very high, long gaps in the stands will result and make mechanical thinning not practical. In most of our present monogerm strains, the seed is quite flat, disc shaped, and highly variable in size, in general, quite small. We are making every possible effort to develop larger seeded monogerm strains in an attempt to overcome this difficulty.

HYBRID VARIETIES

The true breeding monogerm lines we have at present are self fertile. By self fertile, is meant that the beets are predominantly self pollinated. Self pollination leads to a reduction in vigor and uniformity of type. Because of the reduction in vigor accompanying this self pollinating or inbreeding process, these lines can be used on a commercial basis only as parents of hybrids. While most of the inbreds themselves lack vigor, some of them possess the ability to transmit to their hybrid offspring considerable vigor, often referred to as hybrid vigor. Each year we produce some of these hybrids on an experimental scale in an effort to determine which combinations are best. In 1952 we tested in field trials some experimental hybrids made by crossing a male sterile line, obtained from the Division of Sugar Plant Investigations of the USDA, with some of our own most promising material. Two of these performed exceptionally well in these variety trials. While these are still some problems to be worked out in the maintenance of male sterile lines before hybrids become a commercial reality on a large scale, results such as described above lend encouragement to continued work on hybrids.

LOW TEMPERATURE GERMINATION

Another project on which we are now working is toward the development of beets capable of germinating more rapidly at low temperatures. In many areas of California, planting in December, January and early February is highly desirable. At that time of the year the ground temperature is low and germination is slow. Anything that would speed emergence would help assure a satisfactory stand of beets. In laboratory tests it was shown that wide differences in cold temperature germination existed both between and within varieties. Subsequently, selections were made in many strains in an attempt to improve cold germination. Some strains showed more response to selection than others. Some strains gave indications that very little improvement could be made by selection. Others, however, showed surprising improvement. One selected strain after ten days at 42° F. in the laboratory in a replicated test showed a germination of over forty per cent. The strain from which it was selected germinated six per cent and the check, U.S.22, was five per cent.

In 1952 we greatly expanded our variety testing program in an effort to determine the varietal requirments for the different areas in which Spreckels Sugar Company contracts sugar beet acreage. Evidence is beginning to accumulate that certain varieties perform better in some areas than in others and we are attempting to produce varieties best adapted to each area.

SUGAR BEET PATHOLOGIST RETIRES FROM USDA

USDA photo 19

DR. EUBANKS CARSNER, familiar to California sugar beet growers for his splendid work in the fight against curly top, has retired from his post as Senior Pathologist at the Riverside station of the U. S. Department of Agriculture.

Carsner, born in Texas, and a graduate of its university, earned his M.S. and Ph.D. degrees at Wisconsin. He has been on curly top research work ever since he came into the Bureau of Plant Industry's Sugar Investigations in 1917.

His first station was at Spreckels, California. There he worked with C. F. Stahl, of the Bureau of Entomology, and in cooperation with Spreckels Sugar Company. Early in 1919 Dr. Carsner and Mr. Stahl transferred the base of their operations to Riverside. Here the breeding work on curly top resistance was continued, using for breeding stocks the seed from the few beets which had survived intense attacks of the virus in California and Idaho.

In 1929 the program was expanded and reorganized. The breeding phase was assigned to Dr. F. V. Owen at the Salt Lake City station, while Dr. Carsner directed the work from Riverside. With the assistance of many co-workers of the Department, State experiment stations and the beet sugar processors, he has had a part in the development of one after another of improved varieties of sugar beets, beginning with U. S. No. 1, the first commercial variety resistant to the disease. The variety now most widely used, and seventh in the line, is U.S. 22/3.

Like many retired Department of Agriculture scientists, Dr. Carsner is continuing to serve the Government and the farmers as a collaborator without pay. He will continue to make his home in Riverside, California, where he has lived for 33 years.

SUGAR BEET PEST CONTROL

By W. HARRY LANGE, JR.
Associate Professor of Entomology, University of California, Davis

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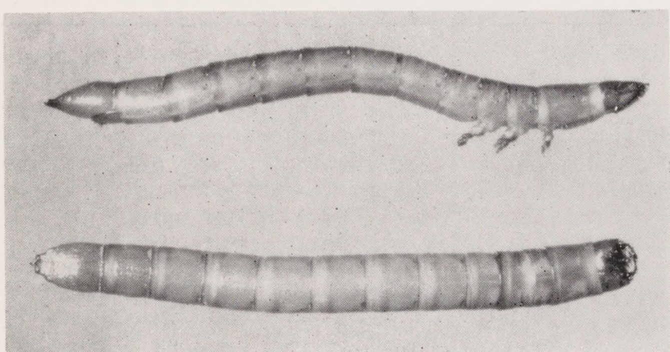
THE 1952 season has clearly demonstrated that the grower of late spring or summer planted beets must pay particular attention to pest control particularly prior to and just after thinning. The hand-writing was on the wall as early as 1949 when late planted beets in the Sacramento Valley were attacked by the sugar beet crown borer, a sporadic pest of sugar beets in California.

Although a number of new insecticides are available to the beet grower for the control of most sugar beet pests he can often save himself trouble through the use of sanitation and cultural methods. It takes good farming and timely attack with chemicals to do the job. Weed control is a prime necessity as a weedy field often harbors many worms or other insects which readily move over to the young beets after thinning and cause damage. Good sanitation in the field is often of value particularly in reducing hiding places for cutworms, or in preventing root aphids from carrying over in the fields on old beets.

The key requisites for the control of pests of late spring or summer planted beets can be itemized as follows: 1) Good sanitation, use of rotations, weed control, good cultural methods; 2) Plant seed treated with at least an adequate fungicide and in most cases a fungicide-insecticide combination treatment for both pre-emergence damping off and wireworm control; 3) Apply insecticide applications to young seedlings early when pests first occur on the plants; and 4) Watch for later attacks of defoliating worms, leaf miners or other pests and apply insecticides if necessary.

SEED TREATMENT

Seed treatment with an adequate fungicide-insecticide mixture has proved economical, effective, and reasonably safe under most conditions. Lindane has proved most effective for wireworm control because of its rapid killing effect, and the residual nature of the chemical on the old seed balls in the ground. The 5.33 ounce dosage of 75% lindane per 100 pounds of seed usually affects from 80 to 93% of the wireworms in the seed zone, and affects wireworms for several months when they come in contact with the old seed balls in the ground. Other chemicals such as aldrin, dieldrin, chlordane, heptachlor, EPN-300, parathion, and others, have been tried on sugar beet seed and may have particular uses as seed treatments, but do not seem to have the general utility obtained from lindane, at least under our particular conditions. The chemicals should be sprayed on the seed and in most cases an adequate fungicide (such as Phygon or Ceresan) should be used with the lindane.



W. Harry Lange, Jr., photo 21

WIREWORM, ***Melanotus oregonensis*** **(Lec.) is here shown 2½ times normal size. While sometimes a serious pest in sugar beets, it is completely controlled by lindane seed treatment.**

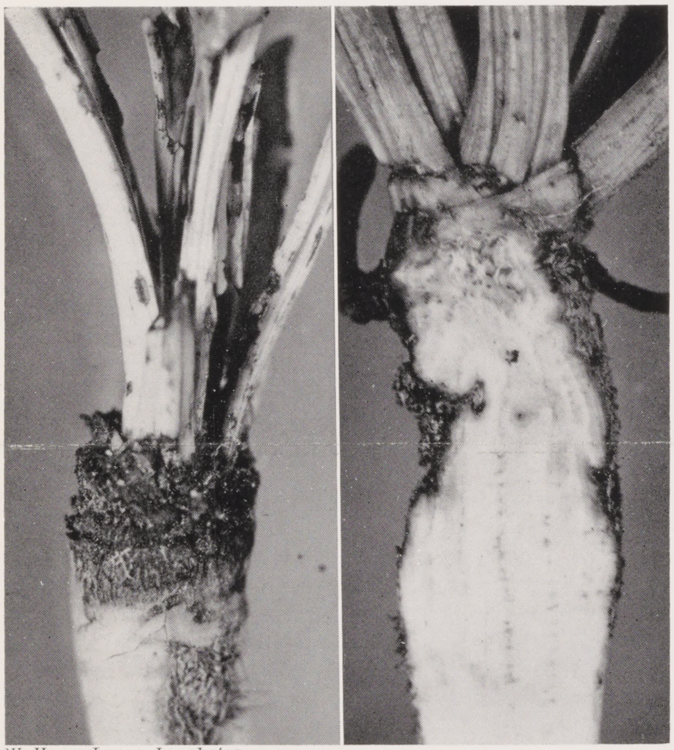
The dangers of storing lindane treated seed do not seem great. A recent trial showed that a two year storage period after treating with Phygon-lindane at the usual concentrations did not affect germination, but did reduce its insecticide efficiency against wireworms by about 50%. It is well not to hold treated seed any longer than necessary as all the factors favorable to seed injury are not known, and it is quite possible that damage can occur under high temperature storage conditions or under other conditions unfavorable to seed viability.

Seed treatment does not ordinarily give much protection against the garden centipede, *Scutigerella immaculata* (Newp.). Tests conducted at Gonzales, Monterey County, indicated that a treatment of 20 pounds of actual DDT per acre or 1.5 pounds of gamma benzene hexachloride were effective in giving control of the centipede. Evidence not substantiated in California indicates that a dosage of 10 pounds of actual aldrin per acre is effective. These chemicals are sprayed on the surface of the soil and disked in 4 to 6 inches. DDT is the slowest acting and has been used in combination with gamma benzene hexachloride. Where root crops are grown in alternation with sugar beets no benzene hexachloride should be used, or at least not within two years of soil treatment, because of possible tainting of the crop. To date aldrin has not shown indications of any objectionable effect on carrots or sweet potatoes. DDT at 10-20 pounds per acre and aldrin at 5 pounds per acre will control wireworms when applied in the same manner. Ordinarily with garden centipedes only the badly infested spots (usually low areas) in the field should be treated. In the Salinas area fumigation with 40 gallons of D-D mixture per acre was also effective in controlling the garden centipede. In soils of high organic content fumigants may not be effective.

PROBLEMS OF YOUNG BEET PLANTS

Many different kinds of worms, or darkling ground beetles may attack the seedlings as soon as they are out of the ground and for several weeks thereafter. It is necessary to watch closely for the pests or evidence of their feeding.

In recent years the greasy cutworm, *Agrotis ypsilon* (Rott.), has been a serious threat to seedling beets. They cut off the seedlings at the ground level and often remain in cracks and under clods and are



W. Harry Lange, Jr., photos

LEFT—Damage and blackening of crown due to feeding of larvae of sugar beet crown borer, ***Hulstia undulatella*** (Clem.).

RIGHT—Sugar beet split longitudinally, showing damage from sugar beet crown borer.

difficult to reach with insecticides. The sugar beet crown borer, *Hulstia undulatella* (Clem.) feeds on the crowns of young seedlings and may cause scars or other disfigurement of the beets, or complete girdling and death. The sugar beet armyworm, *Laphygma exigua* (Hub.) are primarily defoliators, but can roll the leaves and feed on the crowns of seedlings. Darkling ground beetles of several different species partially girdle or cut off the plants at the ground.

For a combination control of worms and darkling ground beetles, a dust containing 5%DDT and 2% parathion has proved the most effective when applied at from 25 to 35 pounds per acre, and preferably by a ground machine. A second application may be necessary. Parathion is necessary if the crown borer is present unless greater amounts of DDT are used. Sprays containing these materials are effective particularly if concentrated in the rows by ground machine. Where the greasy cutworm is a problem it may be necessary to go to 2-3 pounds of actual DDT per acre and concentrate the material in the rows by means of a ground spray machine.

PROBLEMS OF LARGER BEETS

Larger beets should be watched for defoliation by the beet armyworm or other lepidopterous pests. Usually on the defoliators a 5% DDT dust is effective at 20-35 pounds per acre. Applications of DDT may increase the leaf miner problem in certain areas and under specific conditions. The leaf miner of the coastal areas, *Liriomyza langei* Frick, often builds up following DDT applications for leafhopper control.

(Continued on next page)

SUGAR BEET FERTILIZERS IN GOOD SUPPLY

By SIDNEY H. BIERLY

Executive Secretary and Manager, California Fertilizer Association

THE PURPOSE of this article is to discuss the kinds of fertilizer in demand by sugar beet growers, together with a picture of the availability of these materials during the year 1953. Since sugar beet culture is carried on in many geographical areas of California, involving a great many different types of soil and climatic conditions, the information is necessarily somewhat generalized.

Nitrogen continues to be the most important plant food material from the point of view of soil requirements in most parts of the State. However, it does not necessarily follow that the replacement of nitrogen alone in these soils is going to take care of all of the requirements of sugar beets or any other crop. California soils were endowed by nature with high phosphate and potash content. As the land produces crops, however, these vital plant food elements are used up.

Due to the crop rotation practices which are followed and into which the production of sugar beets falls very nicely, much of the land which produces sugar beets has been intensively cropped through the years. The University of California has recently found many areas which are becoming deficient in phosphate and in some cases this is true in regard to potash as well. Unless there is a balance of plant food elements available to growing plants they will suffer and the net result will be loss of both volume and quality in the crop concerned. There are areas in which plant-mixed fertilizers are used successfully, although there is no formula which will apply to all soils; so it is suggested that individual sugar beet growers follow one of the following three courses in order to determine as closely as possible what the fertilizer requirements might be.

1. He may look to the sugar company technicians.
2. He may contact for the services of a qualified commercial soil testing laboratory.
3. He may seek the advice of his County Farm Advisor.

The supply situation for the year 1953 is going to be somewhat better than it was last year. In the field of nitrogen there are several materials which are in wide-spread use by sugar beet growers.

Ammonium nitrate will be in somewhat shorter supply than was the case in 1952. An estimate was presented to the Twenty-Ninth Convention of the California Fertilizer Association in November 1952 that tonnage of this material will be short approximately 25% of the expected demand.

Ammonium sulphate is currently in good supply with new production facilities coming into being, it is expected that normal demands of this material can be taken care of.

Anhydrous ammonia will be available in approximately the same tonnage as was the case last year.

(Continued on next page)

Urea supply is currently running behind demand. However, importations of pelleted urea are expected to take up a substantial portion of the slack.

Calcium nitrate and nitrate of soda are both expected to be available through the season in the same quantities as was the case in 1952.

Ammonium phosphates (16-20-0 and 11-48-0) will be available in approximately the same quantities as during the 1952 season according to suppliers. Demand for these materials however is expected to continue considerably higher than the available supply.

Super phosphate will be in adequate supply from production plants located in Vernon and Stege. Treble super phosphate was in short supply during the fall of 1952, but spring shipments are expected to equal the quantities shipped into California last spring.

Both sulphate and muriate of potash will be in adequate supply during the entire season, unless demand should be stepped up in unforseen volume.

Mixed fertilizers will usually be readily available.

It is suggested that sugar beet growers who have dry storage facilities on their farms should purchase their anticipated requirements of the scarce materials well in advance of the actual need in the field, so as to be sure that their crop will not suffer through later inability to purchase the material of their choice.

The commercial fertilizer industry in California adequately services every agricultural area of the State. There are fifty-five fertilizer mixing concerns in the membership of the California Fertilizer Association, many of which maintain branches scattered throughout the agricultural areas which they serve. A list of Association members is available upon request to California Fertilizer Association, 475 Huntington Drive, San Marino, California.

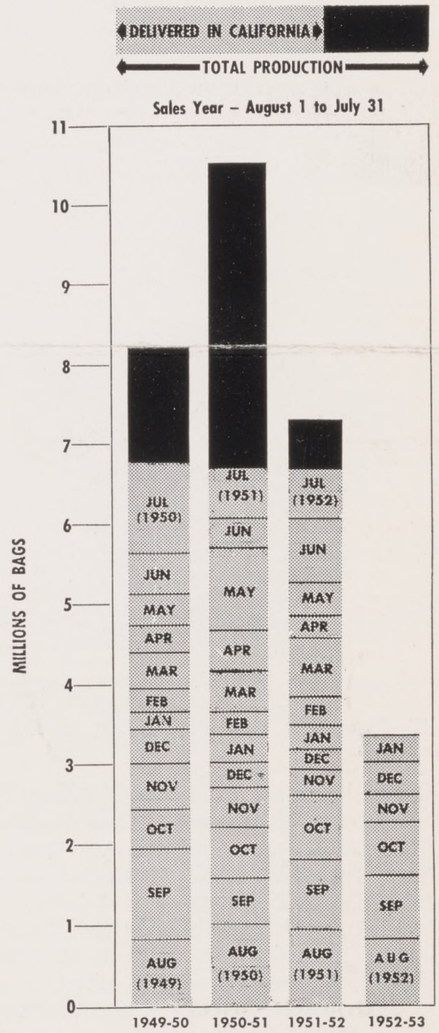
PEST CONTROL

(Continued from page 15)

The valley leaf miner, *Liriomyza subpusilla* (Frost) is the main leaf miner of the interior valleys. Experimentally, dieldrin at the rate of 8 ounces of actual chemical per acre has proved effective in reducing injury from these leaf miners, but control is usually not necessary.

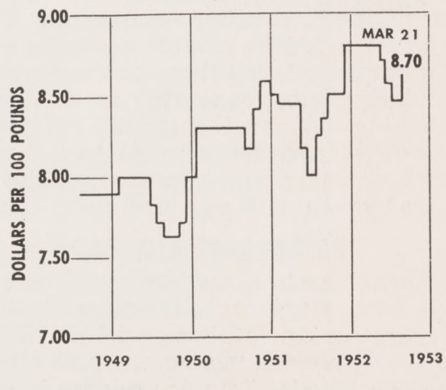
The beet root aphid, *Prociphilus betae* (Doane) is an occasional pest of older beets. This aphid in California does not have a sexual cycle and form galls on cottonwoods, but apparently goes through continuous asexual cycles on many hosts. Favorite host plants are curly dock and other *Rumex* spp., and during the summer and fall it may go through several cycles on lettuce. Work for two years on the Hastings Tract near Rio Vista indicated that two new systemic materials Pestox and Systox were only partially effective when used as foliage sprays to half grown beets. Good cultural conditions and adequate sanitation often assist in obtaining control.

PRODUCTION AND DELIVERIES OF BEET SUGAR IN CALIFORNIA



QUOTED PRICE OF BEET GRANULATED SUGAR

In 100 Lb. Paper Bags, F.O.B. San Francisco



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The SPRECKELS SUGAR BEET BULLETIN is issued bi-monthly by the Agricultural Department of the Spreckels Sugar Company as a service to its growers.
Mention of specific methods, devices or implements does not constitute an endorsement by the Company.
All photographs by the editor unless otherwise indicated.
AUSTIN ARMER, Editor 600 California Fruit Building Sacramento 14, California

SPRECKELS SUGAR BEET BULLETIN

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SPRING CAMPAIGN

Spreckels factories operated in March and April, using sugar beets which were

OVERWINTERED

SPRING HARVESTED

Grower benefits from this program are discussed on page 18.

Vol. 17 MAY - JUNE, 1953 No. 3

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

SUMMER PLANTING FOR SPRING HARVEST

By HUGH F. MELVIN,
District Manager, Sacramento-San Joaquin Valleys

FOR THE PAST three seasons, Spreckels Sugar Company growers have over-wintered beets that were processed in the spring. Over this period, records prove that average yields and sugar have increased substantially. One point is important, however. If over-wintering is to be done, it should be on beets that are in well-drained land, and in land that is not subject to flood waters.

After beets were over-wintered successfully for two seasons, a considerable acreage was planted in the summer months of 1952, for harvest in the spring of 1953. These beets were planted from June to September, inclusive, with the earlier plantings bringing the better returns. Although some fields in the south San Joaquin Valley were planted rather late, they still produced good commercial crops.

The success of this program was heartily acclaimed by growers, as it means if this plan is followed, there is a wider range for planting and still plenty of time remains for beets to produce high yields. Further, the necessity of harvesting prior to heavy fall rains is eliminated.

This summer planting-over wintering-spring harvest method fits in well with California sugar beet culture for the following reasons:

1. A more efficient fall harvest becomes possible.
2. A longer planting season is available to the grower.
3. Three crops can, in some instances, be planted in two years by planning a careful rotation.
4. Water savings are realized in some areas, while in those of low rainfall, water can be used more efficiently because of other crop requirements.
5. Production costs are generally reduced in most areas, (lower irrigation costs, fewer weeds, less labor required, etc.)
6. More acreage can be planted annually.

There are some areas in which Spreckels Sugar Company growers are producing sugar beets where this plan of summer planting seems more adaptable than in others. The plan seems to fit particularly in the San Joaquin Valley because of the lower rainfall and longer seasons there than in the Sacramento Valley. However, in the northern area, this method has proved successful when earlier plantings were made to permit maximum growth prior to the winter months. Based on the results of the past season, beets planted before August, in most cases, produce satisfactory yields.

25

SUMMER-PLANTED beets were harvested for the demonstration on the Freeman contract near Firebaugh.

SUMMER PLANTING
OVERWINTERING
SPRING HARVEST
make it possible to process beets in March and April

26

DEMONSTRATIONS OF MACHINE THINNING ARE WELL ATTENDED

SUGAR BEET growers in California are accepting mechanical thinning. This conclusion is certainly justified if the attendance at a series of field day demonstrations is a measure of grower interest.

On March 16th the California Beet Growers Association, District No. 7, sponsored an elaborate mechanical thinning demonstration on the Ranch of Association President Arnold Frew near King City. The demonstrations (and an outstanding barbecue) were attended by over 500 growers, sugar company staff members, and exhibitors. District President Bob Wood is to be congratulated on the splendid programming which not only provided a smoothly run field demonstration, but more particularly because the work of the various thinning machines was laid out in plot form by Mr. David Ririe and Jack Hills of the Agronomy Department, University of California, Davis. These plots, replicated for significance, will be harvested to determine exactly what can be expected of mechanically thinned beets in comparison to the yields of hand thinned beets.

On April 7th a second demonstration was held near Woodland on two fields contracted by Lloyd Eveland. Here, again, the Extension Division of the University laid out the plots and will record harvest data. David Holmberg, Yolo County Farm Advisor, supervised the plots.

On April 9th Spreckels Sugar Company was host to growers in the Southern San Joaquin area, where two fields were studied, both as examples of mechanical thinning and of late summer planting for Spring harvest. Attendance exceeded 100 interested growers.

The success of all of these field days points up the value of full-scale demonstrations under realistic conditions as a potent means for presenting new developments and techniques in sugar beet agriculture.

Sacramento Bee Photo by Irving Camp 27

DAVID HOLMBERG, Yolo County Farm advisor, supervises hand labor on the Lloyd Eveland plots near Woodland.

Jack Hills photo 28

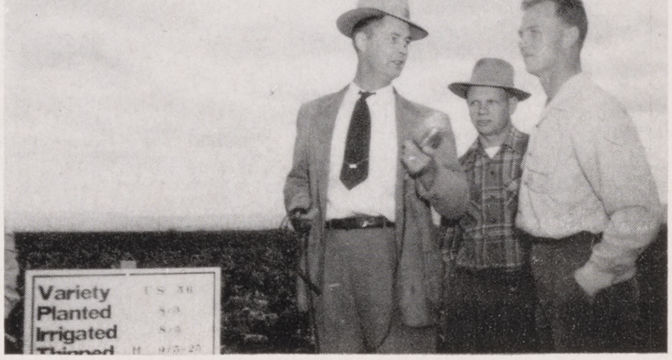
EACH EVENT at the King City field day was announced over a powerful public address system.

29

A LARGE and attentive audience heard Dave Ririe and Jack Hills describe their machine thinned plots on Arnold Frew's ranch.

30

EACH thinning machine was demonstrated under actual field conditions.



31

VARIETY PLOTS on the Freeman contract near Firebaugh were explained by Russell Johnson, John Lear and Kenneth Groefsema.

INGENIOUS DEVELOPMENTS IN SUGAR BEET MACHINERY

FROM TIME to time, the achievements of Spreckels growers in developing new tools has been noted in the pages of the Sugar Beet Bulletin. 1953 is no exception, for the inventiveness of growers and contractors has yielded some noteworthy devices for increasing the efficiency of crop production.

THINNING MACHINES

In keeping with the widespread interest of mechanical thinning, a number of growers have contributed their own ideas and skills to the problem of mechanical thinning.

Ted Holthouse, long-time Spreckels grower at Hollister, has developed a radically novel blocking machine. Mounted on a sled and powered by its own little engine, four rows are blocked at once. Because the cutting hoes perform the same positive chopping action of a skilled hand thinner, the machine will operate in the hardest ground, and in crop plants too large to be chopped by conventional rotary cutter heads. This machine is being produced on order by the Wiebe Manufacturing Company of Hollister.

32

PELUCCA BROTHERS built this tractor-mounted thinner, using obsolete Dixie cotton choppers and Silver cutter heads.

33

WILLIAM LIDER displays his neat combination of Dixie beet thinner and rear-engine tractor.

A highly satisfactory combination which may be seen in considerable numbers in the Woodland area originated with an idea conceived by William Lider of Davis. He mounted a single ground-wheel Dixie thinning machine on the tool bar of an extended AC Model G tractor. The work was done in the Dixon shops of Solano Tractor and Equipment Company, so the constructional details represent the combined thinking of quite a few able mechanics.

Pelucca Brothers of Modesto built their own four-row tractor-mounted thinning machine using two old type Dixie cotton choppers as the starting point. Results were completely satisfactory and demonstrated the salvage value of these old cotton choppers when ingenuity and mechanical skill are available.

SUGAR BEET HARVESTERS

Parks Brothers, who grow fine beet crops on the Maricopa Flats south of Bakersfield, have rebuilt four International Harvesters to suit their unusual field conditions of sandy soil, 30 inch single beds, and the need for a high daily harvest rate. They discarded the disk topper normally supplied with the International Harvester, and do their topping with an Olson Roto Beater. Two passes of the Roto Beater scrubs off all the tops. Then the modified International digger and cleaner lifts, cleans and delivers to a following truck a brisk stream of sugar beets.

Ed Bailey harvests a lot of beets on contract. Because he must accommodate either single or double row beds, he has widened out his regular two row Marbeet Harvester to accommodate three spike wheels with associated plows, strippers, topping knives, and sickles. The spike wheels are on 15″ centers so that the two outer wheels can accommodate single beds on 30″ spacing, or one pair of adjacent wheels will accommodate double row beds spaced the customary 14x26 inches. Of particular interest is the way the tops are windrowed when this machine harvests its 30″ rows in one pass. Without recourse to any special windrowing device, the tops are laid in tight rows 60″ apart, which can be neatly straddled by the trucks.

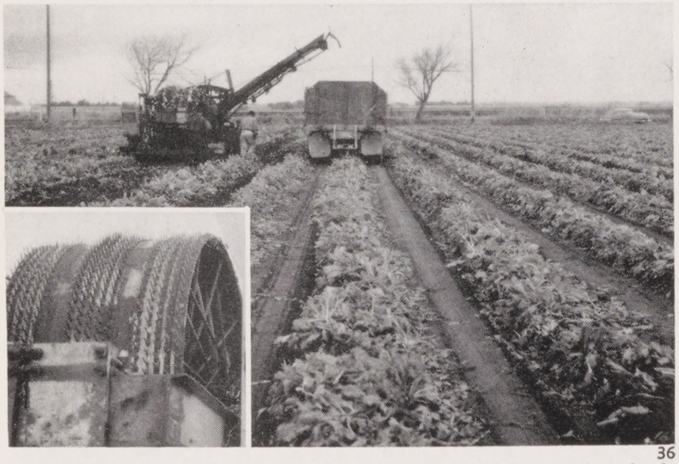
OTHER DEVICES

Wayne Armstrong of Woodland has had a long experience in loading and spreading factory waste

34

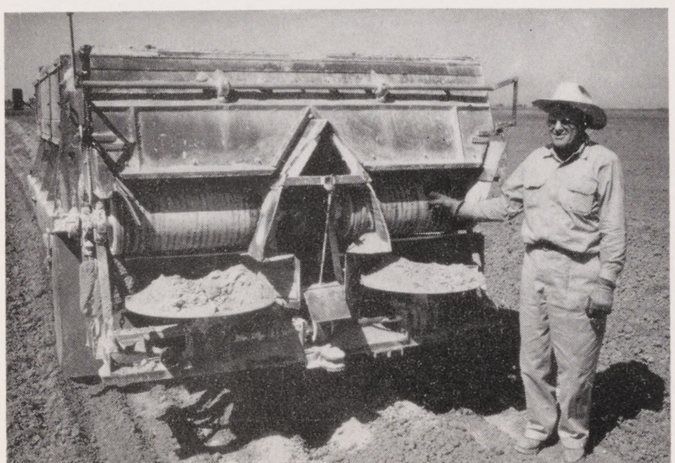
THE HOLTHOUSE blocking machine attracted much attention at the King City demonstrations last March.

35
PARKS BROTHERS' converted International beet harvesters lift and clean pre-topped beets at high speed.



36
ED BAILEY rebuilt his two-row Marbeet to include three spike wheels (inset). He can harvest two 30 inch single beds or one 14-26 inch double bed, and leave neat top windrows on 60 inch centers as shown.

lime. His latest development is a quick-detachable lime spreader which, according to Mr. Armstrong, can be installed by one man in five minutes, so that any one of his fleet of dump trucks can be immediately converted into a lime spreader. A 4-speed transmission controls the feeder belts, while the forward speed of the truck further determines the rate.



37
WAYNE ARMSTRONG points to a variable speed feeder belt on the lime spreader which he designed and built.

IMPROVEMENTS ON THE 1953 MARBEET MIDGET

By E. F. BLACKWELDER,
Blackwelder Manufacturing Company

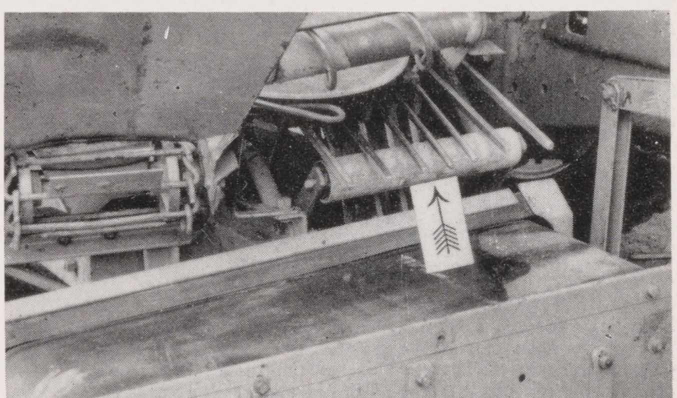
DURING THE 1952 beet harvest season it was determined that several improvements should be made on the Midget harvester. While the overall performance under the various conditions usually found in beet fields from farm to farm as well as from state to state was better than in any previous year of Midget operation, we believe that the new design and operational improvements will make for even better results in 1953. "Luke" Schmidt and the rest of the boys in our engineering department got an early start during the winter so that we were able to test the proposed improvements during spring harvest.

Recommendations for changes were received from growers, sugar company representatives and our own group of servicemen and engineers. Every suggestion was gratefully received and carefully gone over by our committee on Midget improvements. As a result, forty-three were approved for testing. Many were minor, but on consideration seemed important. Our shop completed the trial unit the day before spring harvest started in the Spreckels area at Dixon. The tractor with harvester unit was loaned to a commercial operator who used it during the entire spring campaign. Surprisingly, most of the changes proved satisfactory and were approved to be incorporated in our 1953 production model.

Much interest has been shown in the windrowing of tops. Attachments have been designed and tested but without full satisfaction. A definite step forward proved method by the time harvest starts in the fall.

We are pleased to submit these improvements for your inspection and urge the continuance of the splendid suggestions and cooperation of the past which has resulted in better and cheaper beet harvesting.

The principal improvements are shown in the photographs, and explained in the captions. (Below, and on the next page).

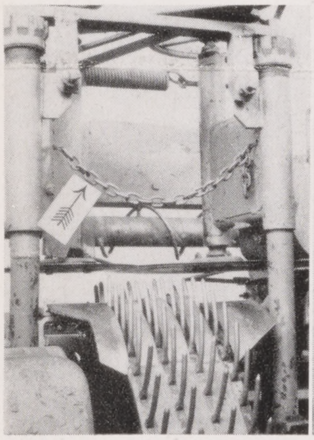


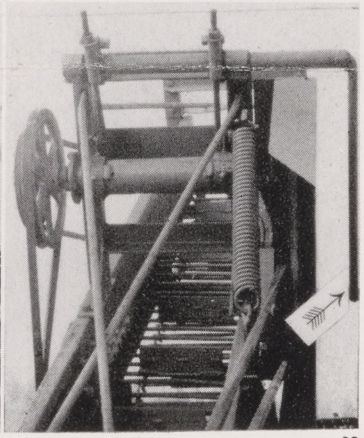
F. W. Tweedy photo
38
A ROLLER is installed under the stripper tails to improve the flow of tops and crowns to the foliage belt. This will decrease the plugging at this critical point and create an even flow to the windrow which will eliminate "slugging" and improve windrow for top recovery.

MARBEET IMPROVEMENTS

(Continued from Last Page)

We feel confident that we have a machine that will outperform previous models, with better mechanical operation, and requiring less attention and care. A generally improved job of recovery, topping and delivery of clean beets can be expected from our new model.

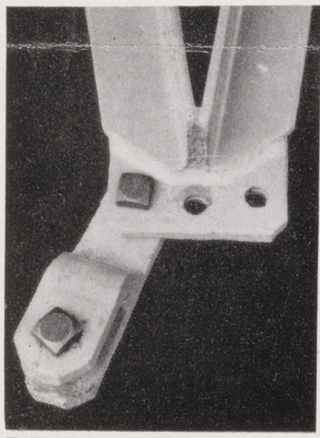


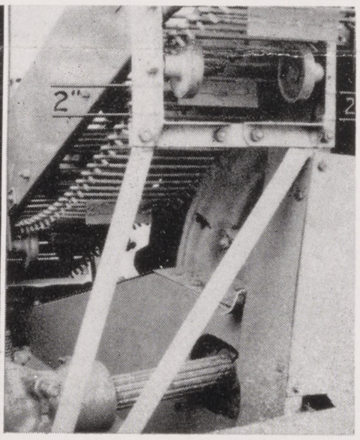


F. W. Tweedy photo 39

A CHAIN has been added between the topping unit frames which holds the tail of the beet while the crown of the beet is being carried through the topping disks by the spikes. This has resulted in excellent topping under most conditions. This chain can be added with little effort to all models.

SEVERAL OWNERS have requested that a clutch be installed in the conveyor so that the operator can stop the potato chain during turning and while unloading the cart. This clutch can be easily installed on all models and the operator can control it from his regular position on the tractor seat.





F. W. Tweedy photo 40

AN ADJUSTABLE swinging hitch is provided on the cart pole which, when properly adjusted, results in a direct line of draft and absence of "crabbing". The pole will be four inches longer and the forward corners of the cart redesigned. Both provide for more clearance in turning.

THE BEET conveyor is raised two inches at the middle support giving greater clearance for the potato chain over the cross member of the "A" frame and which results in four inches additional clearance at the cart. This will permit better loading in the cart and increased turning clearance.

YOUNGSTERS SUCCEED IN CALF PROJECTS

By JOHN KENDRICK
Assistant to General Agriculturist
Spreckels Sugar Company

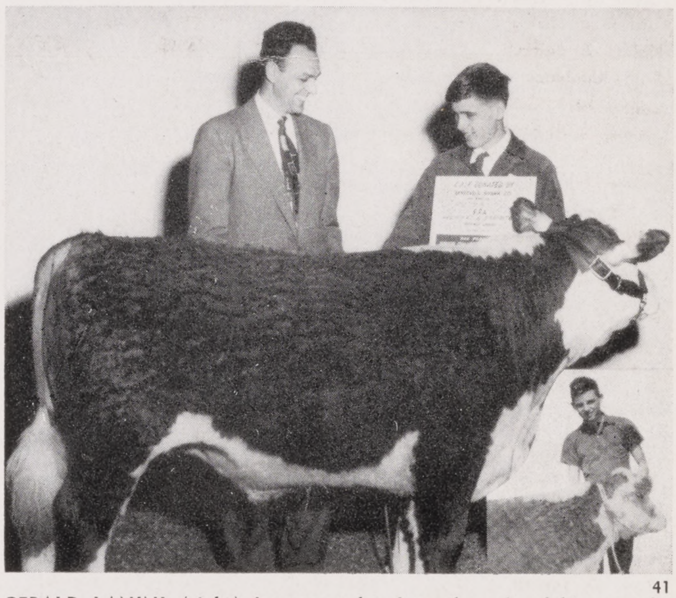
IN THE last few days in March and extending into the Easter Vacation period, young people from all over the state descended upon the Cow Palace in San Francisco for the annual Grand National Junior Livestock Exposition. Among those present was Gerald Lanini, a 17 year old high school junior from the Blanco district just outside the Salinas city limits.

Last year at this same exposition Gerald was a winner in the calf scramble event, and because of his prowess he received a cash donation toward the purchase of a steer calf. Spreckels Sugar Company was the donor of this award. To qualify for the award, Gerald agreed to feed the animal and show it in a fat class of similarly sponsored animals during the exposition this year.

Gerald assumed these responsibilities with eagerness and enthusiasm and as evidence of his ability his animal placed "Choice" under the Danish system of grading in competition with some 30 other animals. The steer, weighing 540 lbs., was originally purchased from the S and S Ranch, Aptos. At the time of sale after the Show, when Lucky Stores purchased the animal, it tipped the scales at 980 pounds for a net gain of 440 pounds.

Young Mr. Lanini attends Salinas High School and is an active member of the Future Farmers of America. His present F.F.A. project includes a steer, two fat lambs and one feeder lamb, which he showed in the Salinas Valley Fair, May 8, 9 and 10, at King City. He is, in addition, the F.F.A. reporter and has a weekly article in the Salinas Californian.

(Continued on Page 24)



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GERALD LANINI (right) is congratulated on the sale of his steer by Guy Manuel. The steer—and Gerald—didn't grow quite as much as the comparison with the inset (photographed last October) would indicate, but the steer's net gain was 440 pounds.

The Honor Roll For 1952

Spreckels Sugar Company congratulates these growers; they have produced yields of 25 tons or more on substantial acreages, and have demonstrated outstanding "know-how" in growing sugar beets.

GROWER	ACRES HARVESTED	TONS PER ACRE	LBS. SUGAR PER ACRE
Harlan & Dumars	50.0	38.04	10,149
Newhall Land & Farming Co.	119.0	36.15	10,989
Ritz Distributing Co.	38.0	35.63	10,254
Frick Bros.	117.0	35.17	10,199
Paul Anthony	30.1	33.76	9,254
Art Manzoni	15.0	33.64	9,671
Con Ferrasci	7.7	32.40	9,695
Geo. P. Lowrie	76.2	32.06	8,953
R. G. Wood	26.0	31.55	9,690
L. & W. Land Co.	4.4	30.91	9,984
Raymond Martin	47.5	30.85	8,564
Tognetti Bros.	20.4	30.74	8,506
M. P. Domingos	36.7	30.57	7,652
Fred Banducci	275.0	30.14	8,433
Schween Bros.	24.0	29.96	10,019
Frank Tavares & Sons	4.0	29.65	10,120
Tognetti Bros.	34.4	29.64	7,095
Lester Stirling	19.6	29.54	9,304
Martella Bros.	40.5	29.51	8,184
Tony Homen, Jr.	29.0	29.47	8,787
Usrey & Taylor	45.0	29.44	9,041
N. Lammers	8.0	29.38	7,985
Albert J. Perry	68.0	29.21	8,798
Silveira & Ross	52.0	29.19	9,977
A. Radavero	8.0	29.00	8,574
Paul M. Closter	26.8	28.93	8,950
John Silveira & Sons	7.5	28.85	7,751
Con Ferrasci	17.0	28.84	8,651
Wm. R. Baetschen	24.5	28.80	9,254
W. & S. Packing Co.	10.0	28.74	8,410
Corde & Verzasconi	32.8	28.64	7,992
Franscioni, Griva & Son	70.2	28.39	8,997
Holme & Seifert	25.0	28.36	8,571
Fred Banducci	70.0	28.35	8,221
Lanini Bros.	3.5	28.31	10,057
John & Ciro Mancuso	145.0	28.22	9,284
Valley Farms	18.7	28.05	8,581
James Palmer, Jr.	37.0	28.01	8,442
Oji Bros.	26.0	27.94	8,583
Taxara & Machado	75.0	27.92	9,598
Duarte & Frudden	45.0	27.78	8,835
V. Vanoli & Son	23.8	27.73	8,026
Paul Hanson	78.0	27.72	7,817
C. Bruce Mace Ranch	62.0	27.64	9,027
Achille Ferrasci	63.2	27.59	8,005
Meek & Le Maitre	34.0	27.56	8,399
De Serpa Bros.	22.0	27.50	7,089
Jim Fanoe	135.8	27.48	9,006
S. & D. Biancucci	150.0	27.45	8,597
Clark & Togni	52.0	27.39	7,807
United Farms Co.	72.0	27.38	8,735
Schween Bros.	12.4	27.35	8,618
M. P. Domingos	14.8	27.33	7,709
Pete Pedevilla	24.2	27.27	7,677
E. Vosti & Sons	18.7	27.23	8,761
Volk & Jarrott	39.0	27.21	8,451
Merrill Farms	29.8	27.16	8,081
Clark & Romans	63.9	27.15	7,119
Schween Bros.	37.4	27.08	8,839
Lawrence Brickey	71.5	27.07	8,126
C. F. Williamson	7.0	27.04	8,331
C. Bruce Mace Ranch	72.0	27.02	9,462
Antonio F. Silveira	27.0	27.02	8,339
Richard Mahon	30.0	27.01	8,810
Robertson Bros.	40.0	27.00	8,170
Alfred Riva	21.5	26.93	8,340
John O. Rowe	35.0	26.92	8,797
Gill Bros.	30.0	26.84	7,686
Tony Ferreira	67.0	26.68	9,044
Barnard Bros.	40.0	26.59	7,764
Grant & Wilson	47.0	26.61	8,089
Geo. L. Barry	185.0	26.55	7,869
James N. Fulmore	90.0	26.54	8,933
Anthony Vosti	29.4	26.51	8,809
E. M. Olson	30.0	26.45	8,157
C. L. & A. W. Johnson	15.0	26.43	8,912
J. P. Adams & Son	19.8	26.42	9,077
Raymond J. Thorne	18.6	26.36	7,978
John Gardoni	9.5	26.31	8,228
T. G. Bacciarini	42.7	26.29	7,590
Ed Thoming	60.0	26.27	8,611
Frew Bros.	90.0	26.27	8,306
L. & W. Land Co.	17.0	26.27	7,894
Storm & Rhodes	46.3	26.26	8,189
William D. Crinklaw	69.5	26.25	6,398
Van Smith	135.0	26.15	8,273
Resetar Produce Co.	10.0	26.13	7,228
Erwin Robasciotti	22.6	26.06	8,362
H. & R. Kodoma	15.0	26.05	8,533
Paul Odermatt	32.0	26.04	7,759
M. G. Machado	35.0	26.01	8,364
Bassi Bros.	77.0	25.97	7,635
Joe Pacheco	30.3	25.93	8,551
Otto Burgdorf	59.0	25.93	7,265
Raynold Boone	16.0	25.83	8,750
C. L. & A. W. Johnson	28.0	25.83	8,583
Ira E. Hudson & Son	134.2	25.83	8,432
Carl H. Becker	154.0	25.75	7,941
Arcotti Bros.	22.8	25.68	8,540
Paul Hanson	38.0	25.68	7,786
Gomes Bros.	10.0	25.61	7,670
Trafton & Stephenson	20.0	25.60	8,483
Dixon Dryer Co.	35.0	25.58	8,042
Newhall Land & Farming Co.	30.0	25.51	8,918
J. Tadlock	21.0	25.41	8,863
Wesley & Randall Reiff	21.0	25.41	7,465
Frank Tavares & Sons	17.0	25.39	8,734
Jacop Bros.	35.0	25.38	8,220
C. Bruce Mace Ranch	325.0	25.37	7,803
Tom Storm	20.5	25.36	9,134
Frank A. Fields	9.2	25.28	7,655
R. M. Baty	50.0	25.25	5,923
Everisto Sousa	40.0	25.20	8,179
Louis P. Battinich	52.0	25.16	8,283
McDonald & Whealey	143.0	25.11	8,396
Michael K. Reed	27.6	25.09	6,547
D. E. Freeman	75.0	25.05	7,985
M. G Da Rosa	66.3	25.05	6,557
Estes & Strobel	30.8	25.04	7,897
Carl H. Becker	181.0	25.03	7,579

SPRECKELS FIELD SUPERINTENDENT IS HONORED

Grover McCandless, who has been field superintendent in the Hollister-San Juan district since 1933, was honor guest at a banquet given by Hollister-San Juan growers on April 26 at Hollister.

The dinner was in recognition of the service McCandless has given to the growers in the area. The good will of the group was accented by the presentation to McCandless of a gold watch from the group.

McCandless, who retired from active work on January 1, is still continuing to serve the company and growers in a consulting capacity.

YOUNGSTERS SUCCEED

(Continued from Page 22)

Gerald's plans for the future include attending California Polytechnic at San Luis Obispo with a major in truck crops. He should be well suited for this subject since his family farms vegetable crops in the Blanco District. In addition to vegetables, last year the Lanini farm produced sugar beets, which yielded 28.31 tons to the acre, with 17.76 percent sugar.

Spreckels Sugar Company considers it a privilege to assist young people of Gerald's caliber to obtain experience in an agricultural vocation.

Another youngster present at the Junior Show this year was Miss Janice Brittsan from Stockton, California. She is a member of the Waverly 4-H Club of San Joaquin County. Janice is the current recipient of the Spreckels Sugar Company award and will show her calf in next year's event. She will add the feminine touch to the growing family of Company sponsored youngsters.

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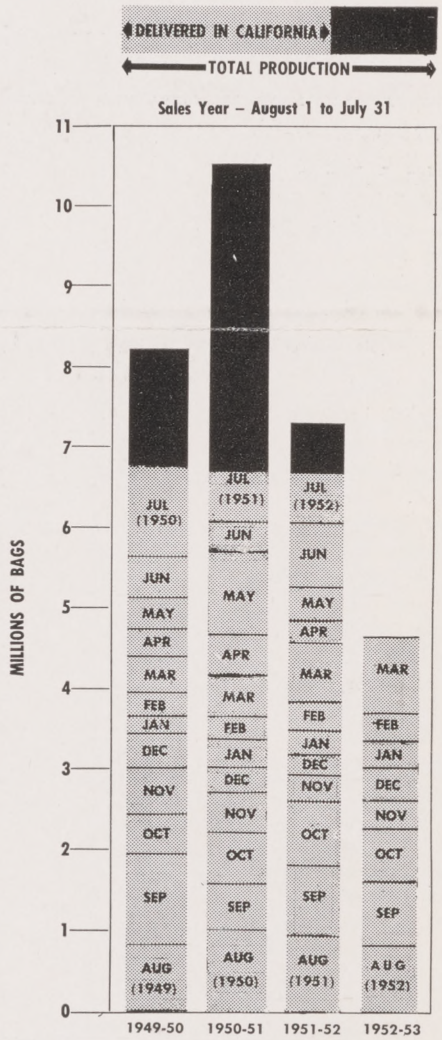
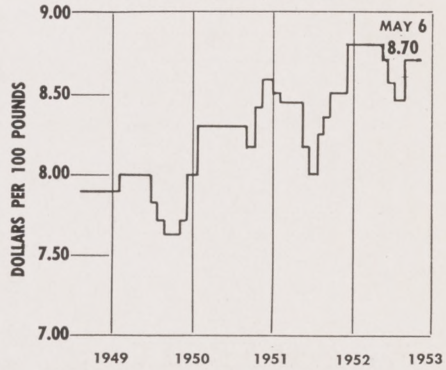
JANICE BRITTSAN receives her calf award from John Kendrick.

PRODUCTION AND DELIVERIES OF BEET SUGAR IN CALIFORNIA



QUOTED PRICE OF BEET GRANULATED SUGAR

In 100 Lb. Paper Bags, F.O.B. San Francisco



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The **SPRECKELS SUGAR BEET BULLETIN** is issued bi-monthly by the Agricultural Department of the Spreckels Sugar Company as a service to its growers.
Mention of specific methods, devices or implements does not constitute an endorsement by the Company.
All photographs by the editor unless otherwise indicated.
AUSTIN ARMER, Editor — 600 California Fruit Building — Sacramento 14, California

SPRECKELS SUGAR BEET BULLETIN

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ARITHMETIC IN THE BEET FIELD

There are innumerable calculations needed in growing a crop of sugar beets. They apply to:

- LAND MEASUREMENT
- PLANTING
- THINNING
- FERTILIZING
- IRRIGATING
- HARVESTING

Some helpful shortcuts in solving these problems are presented on pages 28 to 30

Vol. 17 JULY - AUGUST, 1953 No. 4
PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

THE UNIVERSITY SUGAR BEET RESEARCH PROJECT

By DAVID RIRIE[1]

A COMMON springtime complaint of the sugar beet grower or field man in the state of California is related to obtaining a satisfactory stand. With crusting, damping off, drought, and other factors to contend with, it is no small wonder that stand problems are suggested for research activity time and time again. With this need in mind, a part of the research program at Davis is, and will continue to be, concerned with developing practices leading to stand improvement.

STAND IMPROVEMENT

Fertilizer placement has been suggested as a possible means of giving the seedling a more vigorous start. Most of the work along this line has been confined to greenhouse tests. In these experiments Ryde clay loam, a known phosphorus-deficient soil, and Yolo fine sandy loam have been studied. In the first test with Ryde clay loam several phosphorus source materials at different rates were tried as soil row spray treatments with the seed. At forty pounds of P_2O_5 per acre such materials caused a delayed emergence, but produced larger seedlings. By placing the materials one inch below the seeds in subsequent tests at 40 pounds of P_2O_5 an acre, the delayed emergence did not occur and a growth response was noted. This is shown by the data in table 1.

TABLE 1. The Effect of Phosphate Fertilizer on Sugar Beet Seedlings Grown in Ryde Clay Loam Soil.

Treatment	P_2O_5 lbs./Acre	Mean Emergence Period in days	Seedlings per 20" row	Seedling Dry Weight at One Month in Mgms.
Agrophos	40	5.9	52	158
$(NH_4)_2HPO_4$	40	5.7	52	220
Treble superphosphate	40	5.9	52	148
Check	—	6.1	48	80

The data of this table would indicate that further trials with placed applications of phosphorus may lead to beneficial results on soils having a tendency to be deficient in phosphorus.

Tests with the same materials on Yolo fine sandy loam have shown that phosphate fertilizers placed below the seed have not delayed emergence, but only the $(NH_4)_2HPO_4$ treatment resulted in larger seedlings. This suggests a need for further study of the effect of carefully placed applications of nitrogenous fertilizers on early seedling growth.

The use of soil conditioners as crust preventives has been proposed, and both greenhouse and field tests have been or are now being conducted to determine their effectiveness. The materials under test include Krilium, Aerotil, and Terralite. A preceding issue in the SPRECKELS SUGAR BEET BULLETIN (July-August, 1952) carried an account of some of the results obtained.

[1]Dr. Ririe is Agronomist with the University of California at Davis. He heads a research program sponsored by the following: American Crystal Sugar Co., California Sugar Beet Growers Association, Ltd., Holly Sugar Corporation, Spreckels Sugar Company, Union Sugar Company, and the University of California, College of Agriculture.

In cooperation with the Agricultural Engineering Department planter press wheels of several different types are being investigated. Results at Colorado A & M College show that variations in type of press wheel and pressures applied to press wheels may have effects on the stands obtained. Several types of press wheels have been imported from Colorado and are now under trial at Davis.

THINNING STUDIES

Another problem confronts the grower soon after he has obtained a stand: how to reduce the stand to the point of best return. Current labor supply, past experience, and the adequacy of various mechanical thinning machines are factors to consider. Labor supplies are often erratic, and the sugar beet farmer is not prone to rely on old methods if better ones can be demonstrated, so his interest has focused on the down-the-row type of thinner or stand reducer. Questions have arisen as to the effects of doubles, multiples, skips, and final population on sugar production. With these problems in mind a phase of this project has been to develop basic information as related to machine thinning. The results of the first test along this line were reported in an earlier issue of the SPRECKELS SUGAR BEET BULLETIN (January-February, 1953). The data indicated no real difference in yield between single beets spaced at 12 inches on the row and single beets spaced at 4 inches apart. Nor was there any difference when as high as 50 per cent of the hills were left as doubles at spacings of 12 and 6 inches respectively. Counts at harvest time showed a tendency toward natural stand reduction at higher populations with only one of a group of closely spaced beets or of a double hill developing to a commercially acceptable beet.

An experiment is now in progress to determine the effects of double and multiple beets at differing fertility levels on sugar beet yields. Four methods of thinning — including short handled hoes, long handled hoes, machine, and machine followed by long handled hoes—are being compared in another test.

FERTILIZER STUDIES

Fertilization is particularly important in sugar beet culture. The key nutrient in California is most often nitrogen, but phosphorus and potassium deficiencies have also been observed in certain areas. Earlier research, for the most part, has been confined to fertility studies with nitrogen, and from such tests several well demonstrated principles have evolved:

(1) A lack of nitrogen results in lower yields, whereas an overadequate supply contributes to a low sugar content.

(2) Although beets in most areas need nitrogen, the amount required varies with many factors including climatic conditions, past crop history, soil type, and adequacy of other growth essentials.

(3) Disease resistance is often higher when nitrogen supplies are sufficient.

(4) Sugar beets suffer from nitrogen hunger when the nitrate-nitrogen supply of the leaf stalks falls below a level of approximately 1000 parts per million. Such a condition is desirable at only one time during the growth of the crop and that is just prior to harvest.

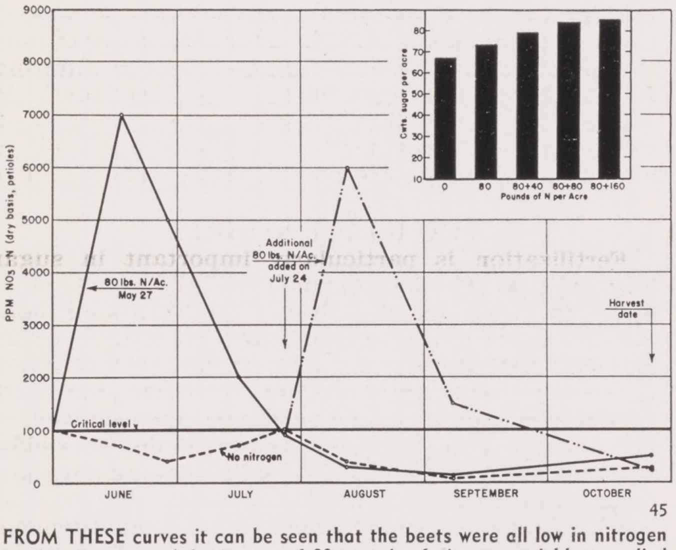
The development of tests to predict fertilizer needs has been a problem of research ever since such elements as nitrogen and phosphorus were demonstrated to be essential to plant growth. One such test, a system of periodic chemical analysis of leaf stalks referred to as petiole analysis, appears particularly applicable to sugar beet fertilization. The cooperation of the Department of Plant Nutrition, the Extension Service, and the Beet Sugar Companies of the state has been enlisted in a program of field tests to evaluate this method. In all of the tests thus far conducted petiole analysis has contributed to a better understanding of the fertility needs of the fields upon which the tests were conducted.[2]

Results of a nitrogen fertilization experiment conducted at Davis in 1952 may serve to illustrate the type of fertilizer work being done. In the experiment there were ten different treatments and a set of plots receiving no fertilizer. The treatments and yield results are contained in table 2.

TABLE 2. The Effect of Supplementary Nitrogen Applications on Sugar Beet Production.

Pounds of N Applied At Thinning	June 23	June 24	% Sucrose Content	Roots Tons Per Acre	Sugar Cwts. Per Acre
0	0	0	15.9	21.1	66.8
80	0	0	15.5	23.6	72.8
80	0	40	15.1	25.9	78.2
80	0	80	14.7	28.5	84.0
80	0	160	14.0	30.4	84.8
80	0	40*	15.4	26.6	81.8
0	40	0	15.9	23.3	74.4
0	80	0	15.6	25.0	75.4
0	160	0	15.0	25.3	75.6
80+P	0	160	13.6	29.7	80.6
80+P+K	0	160	14.1	28.4	80.2

*Applied July 25 and August 25 as Nugreen sprays at 20 lb./Acre each.



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FROM THESE curves it can be seen that the beets were all low in nitrogen at thinning time. A basic rate of 80 pounds of nitrogen quickly remedied the situation, but after reaching 7000 parts per million of nitrate-nitrogen in the petioles, the plant content decreased rapidly. On about July 15, samples taken showed about 2000 parts per million and it was decided that the supplemental rates would be applied on July 24 or just prior to the next irrigation. The supplemental nitrogen gave an excellent response with 80 pounds proving to be the best rate.

[2]A summary of these experiments has been prepared and may be obtained from Mr. F. J. Hills of the Extension Service, Davis. For a more complete statement of petiole analysis as a method for determining the fertilizer needs of sugar beets, refer to the Spreckels Sugar Beet Bulletin (November-December, 1952).

Data from this test indicated that the 80 + 80 pound per acre application of nitrogen was the best treatment, which represented approximately a $44 per acre net gain over no fertilizer application and about $33 per acre over one single application of 80 pounds of nitrogen per acre. The chart of the analysis curves (below) shows how petiole analysis could have helped in arriving at this treatment.

The treatments in which nitrogen was applied late (June 23) proved unsatisfactory. Urea sprays burned the leaves at the concentrations used, but offer some promise, although the resulting sugar yield was not much in excess of that resulting from the basic 80 pound nitrogen application. Tests up to this date favor a system involving early application of a basic medium rate of nitrogen for most soils, to be followed with supplemental applications as indicated by petiole analysis.

During this season the nitrogen fertilization problem will be studied further with particular emphasis on a comparison of pre-plant versus thinning time, nitrogen applications, petiole analysis as a guide to fertilization, and the relationship of nitrogen requirement to plant population.

Closely related to nitrogen fertilization is another question, that of the effect of green manure crops on sugar beet growth. In cooperation with Dr. Williams of the Agronomy Department such studies have begun. The first was conducted in the Santa Maria area using barley, vetch, and barley and vetch together as a winter cover crop preceding sugar beets. The results of this test indicated that vetch added significant amounts of nitrogen to the soil and resulted in a six ton per acre increase. There was also an increase due to plowing under barley, and barley and vetch combined, but the gain was not as great as with vetch alone. When nitrogen fertilizer was also added, however, the barley plus vetch green manure crop was better than vetch alone.

This year a test involving summer green manure crops in Imperial Valley is being conducted and it is anticipated that more experiments of this kind will be conducted at Davis.

OTHER STUDIES

Weed control experiments at Davis during the past summer gave only negative results. This year a larger number of materials are under test with special emphasis on water grass control.

Spring and summer problems have now been discussed with some of the experiments underway to overcome them. The chief fall problem is that of low sugar content and from many sources it has been suggested that the development of practices leading to an enhanced sugar percentage should be an aim of this project. Consequently experiments were continued through last year with maleic hydrazide, a chemical which had shown promise in increasing the sugar content. Results have been erratic with some experiments showing sprays of maleic hydrazide to be of value, and others the reverse. One of the best possibilities for the chemical appears to be

(Continued on Page 31)

ARITHMETIC IN THE BEET FIELD

By AUSTIN ARMER
Agricultural Engineer, Spreckels Sugar Company

FROM THE instant of signing a sugar beet contract to the receiving of his final payment check, the beet grower is obliged to perform innumerable calculations involved in land measurement, planting, thinning, fertilizing, irrigating and harvesting his crop. So we present here some tables and charts, from which can be read directly many of the answers to common problems in beet field arithmetic.

LAND MEASUREMENTS

Following are some of the basic relations in land measurement:

1 mile contains 5,280 feet.

1 square mile (1 section) contains 640 acres.

1 quarter section or 160 acres (when square) is ½ mile or 2,640 feet on each side.

1 sixteenth section or 40 acres (when square) is ¼ mile or 1,320 feet on each side.

1 acre contains 43,560 square feet.

1 acre (when square) is 208.7 feet on a side.

1 acre is a strip one mile long and 8¼ feet (99 inches) wide.

The last item is very handy in computing the NET acreage of a field. Since field roads and irrigation ditches are close to 8¼ feet wide, each mile of such strip deducts one acre from the field's total area.

All of the cultural operations—from plowing to harvest—involve traversing the field with a tractor-drawn tool. One of the first questions which must be answered is "How many acres per hour can I cover with a tool of known width, drawn by a tractor of known speed?" Chart 1 (below) answers this question.

As soon as a row spacing for the crop has been decided upon, the question arises: "How many rows of a given length will there be in an acre?" Chart 2 gives this answer, for either 20 inch or 30 inch row spacing. These two figures were chosen because all double-row beds average close to 20 inch spacing (12-28, 14-26, 16-24, etc.), and most single-row beds are within an inch or two of 30 inch spacing.

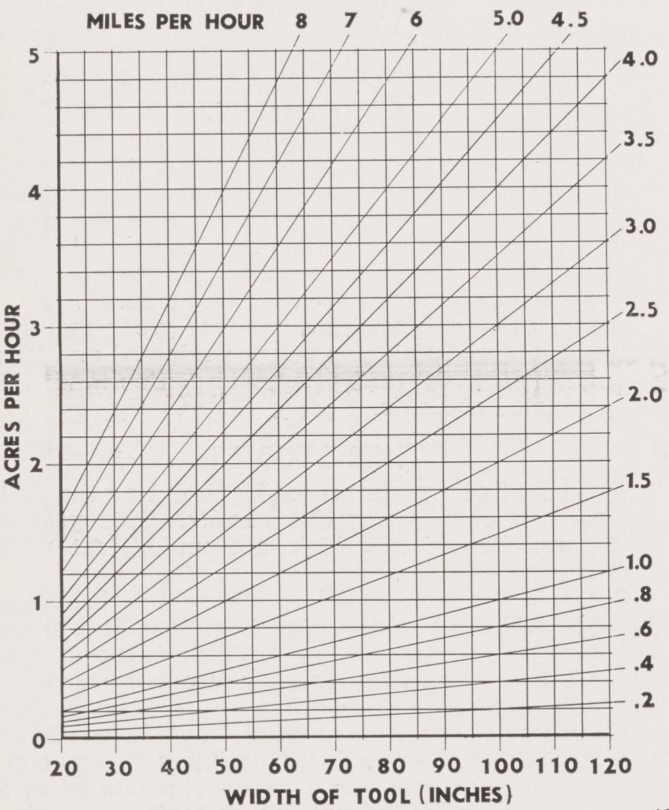
PLANTING

Good judgment dictates one seed every inch; more if conditions are unfavorable, less if they are favorable.

But how many pounds per acre does that mean? The answer is on Chart 3—for either 20 inch or 30 inch row spacing, and for a seed spacing of .7″ to 1.5″ indicated by the shaded area.

When the desired pounds-per-acre is known, the planter can be set up, and is ready to go to work—after a trial to prove that it is metering out as many seeds as it should.

CHART 1



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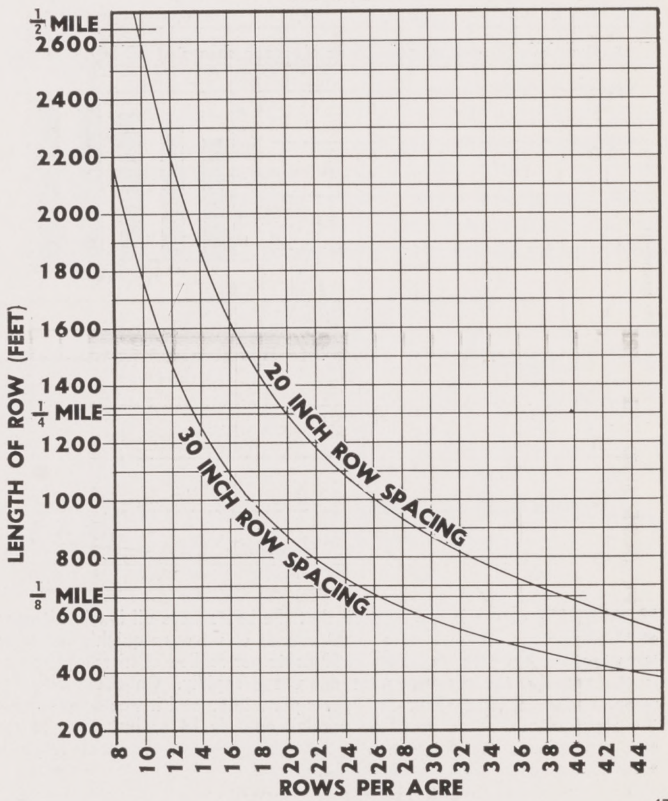
HOW MANY acres per hour can I cover with a beet tool (harrow, planter, cultivator, etc.)? ANSWER—Find the width of the tool in the figures at the bottom of the chart; follow the corresponding vertical line upward to its intersection with the slating line corresponding to the tractor speed in miles per hour; from this intersection, follow the horizontal line to the left and read Acres per Hour.

CHART 2



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HOW MANY beet rows per acre? ANSWER—Find the length of your rows on the left hand column; follow the horizontal line till it meets the curve corresponding to your row spacing; then follow the vertical line from this intersection to the bottom of the chart, where Rows per Acre can be read.

THINNING

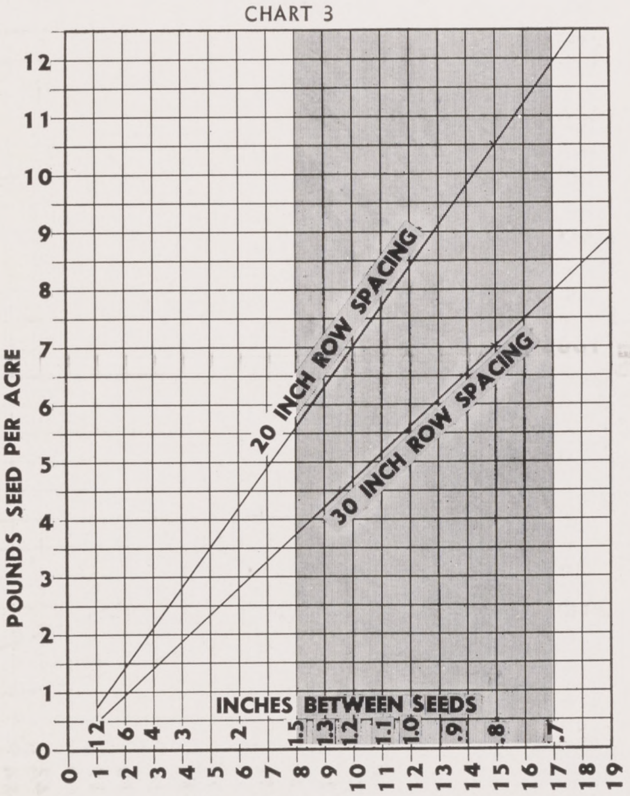
Mechanical thinning can involve some pretty complicated calculations if all theoretical factors are considered. So we present here a skeleton outline of thinning machine set-ups to accomplish satisfactory stand reduction in a reasonable range of pre-thinning stand counts.

TABLE 1

Theoretical Stand (Beets per 100 Feet of Row) Obtained on Various Pre-Thinning Stand Counts, and with Various Cutter Combinations on Dixie and Silver Thinning Machines

	DIXIE			SILVER		
Cutters To Use	20L½	10L2 or 10D2	10L2 Plus 20L½	16x⅝	8x1¾	8x1¾ Plus 16x⅝
Pre-Thinning Stand Counts (Beet-containing inches per 100 inches)						
18	161	......	......	139	......	......
20	178	117	......	154	120	......
22	196	129	......	170	132	......
24	214	141	......	185	144	......
26	......	153	......	201	156	......
28	......	165	122	......	168	108
30	......	176	131	......	180	115
32	......	188	140	......	192	123
34	......	200	148	......	204	131
36	......	212	157	......	......	139
38	......	......	166	......	......	146
40	......	......	174	......	......	154
42	......	......	183	......	......	162
44	......	......	192	......	......	170
46	......	......	200	......	......	177
48	......	......	209	......	......	185
50	......	......	217	......	......	193

CHART 3



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HOW MANY pounds of seed per acre? ANSWER—Find the desired seeds per Foot of Row (or Inches Between Seeds) on the bottom of the chart; follow the vertical line upward to its intersection with the appropriate row spacing. From this intersection follow the horizontal line to the left and read Pounds Seed per Acre. NOTE—The seeds per foot should fall within the shaded area—between 8 and 17.

It would be well if every grower knew how many plants should remain in 100 feet of row (33 paces); or how many inches (average) between plants; or what is really important, how many plants per acre. Chart 4 gives these relations.

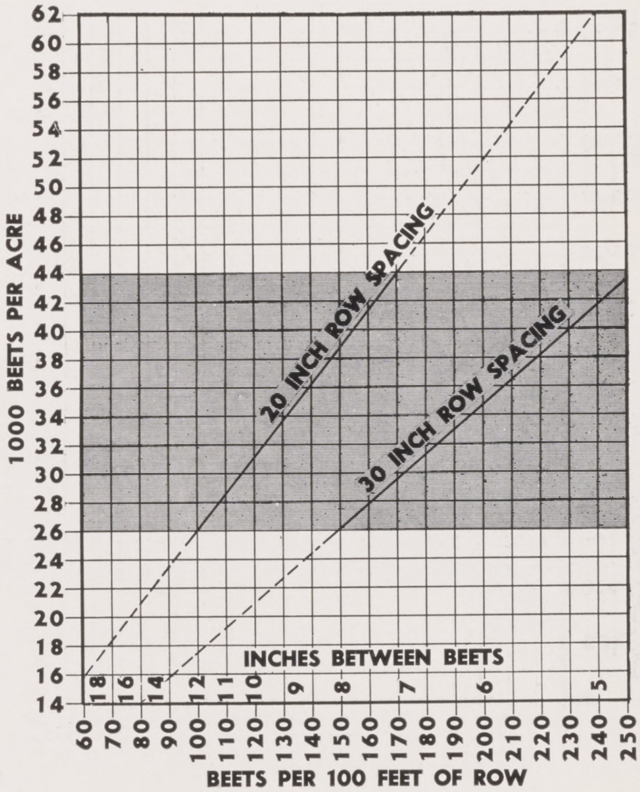
FERTILIZING

Most sugar beet fertilizer programs in California involve the use of Nitrogen alone. True, there are small areas, (principally in peaty or highly organic soils) where beets respond to phosphates or potash. But nitrogen represents the biggest slice of the fertilizer dollar, so beet growers are concerned with the actual pounds of nitrogen purchased in any commercial fertilizer. Therefore, we present Table 2, showing the percentage of nitrogen found in some common commercial fertilizers.

TABLE 2

Name of Fertilizer	% Nitrogen
Ammonia Gas (NH_3)	82
Ammonium Nitrate	32
Ammonium Phosphate	11 or 16 (+48% P_2O_5)
Ammonium Sulfate	20
Aqua Ammonia	30
Calcium Nitrate	15
Cyanamid	21
Potassium Nitrate	12 (+44% K_2O)
Sodium Nitrate	16
Urea (Uramon)	42

CHART 4



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HOW MANY inches between beets should I leave? ANSWER—Find the desired population on the left hand column; follow the corresponding horizontal line to its intersection with the desired row spacing line, and from this intersection follow the vertical line downward to Inches Between Beets and Beets per 100 Feet of Row. NOTE—The population should fall within the shaded area; between 26,000 and 44,000 beets per acre.

This table will serve as a guide in planning a fertilizer program. Actual analyses of particular fertilizers are, by State Law, printed on each container of commercial product.

IRRIGATION

Irrigating sugar beets holds no mysteries—it consists simply of applying the right amount of water at the right time. "How much" and "when" are the only unknowns, and both are easy to evaluate on the basis of experience with particular fields. But how about newly developed fields, or fields planted to beets for the first time? Here is a little table that will give some idea of how much water is needed by different soil types:

TABLE 3

Soil Type	Inches of Water to Penetrate 1 Foot	1 Inch of Water Will Penetrate:
Sandy	1.1 - 1.5	8 to 11 inches
Loamy	1.9 - 2.8	5 to 7 inches
Heavy	3.1 - 4.0	3 to 4 inches

Before the time comes for irrigation, it is well to know how long a pump must operate to deliver water enough for a thorough irrigation, yet without waste of water. So decide on how many inches of water are needed, and Chart 5 will tell you how many hours the pump should run to apply one inch of water for your particular acreage.

HARVEST

Before starting harvest, a grower can estimate his yield if he knows (a) the beet stand, (b) the average weight per beet, and (c) the row spacing.

The formulas are very simple, and are:

For 20 inch row spacing, yield $= 13.068 \times$ (Beets in 100 ft.) $\times$ (Av. weight per beet).

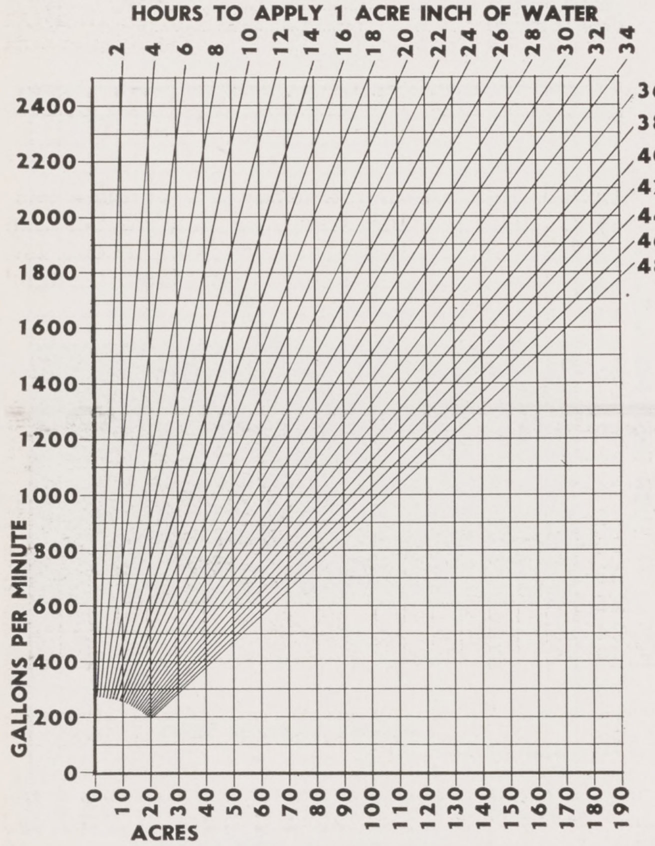
For 30 inch row spacing, yield$=8.712 \times$ (Beets in 100 ft.) $\times$ (Av. weight per beet).

Chart 6 has been prepared to show these formulas as graphs, and to show yields in tons per acre for both 20 inch and 30 inch rows. So, to estimate yield, dig plenty of sample beets and average their weight; make several stand counts and find the average number of beets in 100 feet of row. Apply these figures to Chart 6, and find the yield.

If harvest has begun, and you want to keep track of the yield, it will be necessary to know the number of rows per acre in the particular field. This can be found on Chart 2. Then, to find the yield merely check the number of tons harvested from enough rows to equal one acre.

CHART 5

HOURS TO APPLY 1 ACRE INCH OF WATER



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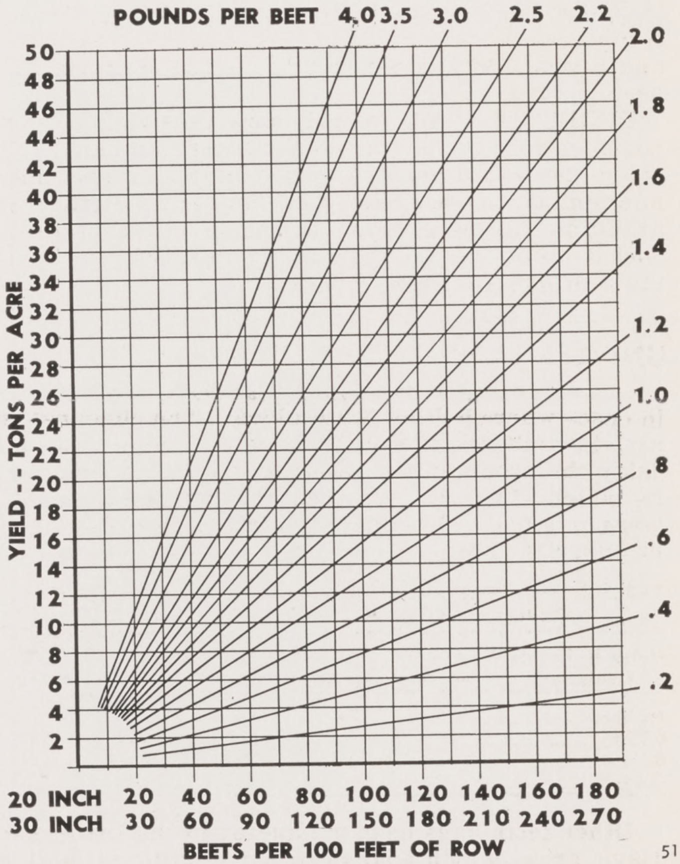
HOW MANY hours must my pump run to apply one acre inch of water? ANSWER—Find the delivery rate of your pump in gallons per minute in the left hand column; follow the corresponding horizontal line to the right until it intersects the vertical line corresponding to the field's acreage at the bottom of the chart. The intersection of these horizontal and vertical lines will occur at the slanting line which, when followed outward, will indicate the number of hours required.

CHART 6



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HOW MANY tons per acre? ANSWER—Find the average beet weight (Pounds per Beet) from the figures on the left or top of the chart; follow the corresponding slanting line downward to its intersection with the vertical line indicating the Beets per Hundred Feet of Row at the bottom of the chart. From this intersection follow the horizontal line to the left, and read the yield in Tons per Acre.

NEW BEET RECEIVING FACILITIES WILL SERVE SPRECKELS GROWERS

IN ORDER to accommodate expanding sugar beet acreage and in keeping with the Company's policy of continually modernizing receiving facilities, the Spreckels Sugar Company is providing six new or improved beet dumps for the 1953 fall harvest.

Entirely new structures are being erected at Crows Landing, Manteca, South Dos Palos, and Spreckels. Increased capacity is being provided for the dumps at Cromir and Sucro, while a piler is being moved to Lockeford for receiving beets in this thriving area. Essentials of the program are here listed:

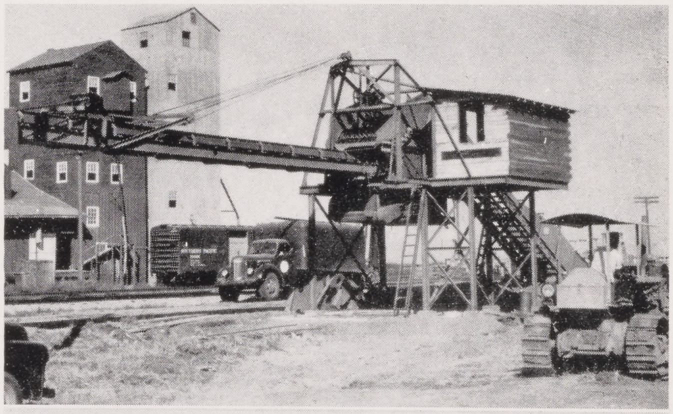
CROMIR. A new 60 ft. truck scale has been installed to accommodate the largest trucks currently used in beet service.

CROWS LANDING. The timber ramp has been replaced with a low level paved ramp. A hydraulic truck hoist will speed up dumping. An entirely new beet hopper incline conveyor and cleaning screen have been installed, as well as a new 60 ft. scale.

MANTECA. An entirely new dump has been built, having a wider hopper and incline belt for more rapid handling of beets. In addition to the previous 34 ft. scale, a new 60 ft. scale has been placed in service.

SOUTH DOS PALOS. A brand new receiving station has been erected. It is of the latest design, similar to those purchased last year for Josephine and Sucro. Here, again, a 60 ft. scale platform has been installed.

SPRECKELS. An entirely new receiving station has been designed by Spreckels Sugar Company. The old timber ramp has been removed and trucks may now unload at very nearly ground level. Particular attention has been given to the handling of beets with a minimum of breakage, coupled with a maximum of dirt and trash removal.



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THIRTY-ONE beet receiving stations serve California growers for Spreckels Sugar Company. Shown in the construction stage are two completely new stations—South Dos Palos (above) and Spreckels (below).

SUCRO. Because of the expanding acreage centering at this receiving station, a new hopper and incline conveyor of increased capacity has been built. A 60 ft. scale deck has also been provided for rapid unloading of the largest trucks.

UNIVERSITY PROJECT

(Continued from Page 27)

in cases where bolting is a problem. The chemical at certain concentration will reduce the number of and delay the production of seed stalks. In the first test in which this was observed the following results were obtained. These data are from a test conducted in Imperial Valley.

TABLE 3. The Effect of Maleic Hydrazide on Sugar Production and Bolting Percentage of Sugar Beets.

Maleic Hydrazide Treatment	Weeks Prior To Harvest	% Sucrose	Tons Per Acre Beets	Tons Per Acre Sucrose	% Bolters
No spray	—	17.6	19.4	3.41	40
0.15%	7	18.0	20.5	3.69	33
0.3%	7	18.2	19.8	3.60	25
0.6%	7	18.8	19.9	3.73	7

Other tests have been conducted in the Dixon and Davis areas which also show a reduction in bolting and a trend toward higher sugar percentages. All of this material has not been summarized or analyzed, but it looks as if maleic hydrazide may be of use for overwintered beets and perhaps on fall harvested

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MALEIC HYDRAZIDE was sprayed on the beets at the left of the stake on March 4, 1953. The photograph was taken on May 7, and shows vividly how the untreated beets bolted.

beets in limited areas for improving the sugar content. More work needs to be done with rates and time of application, and such work will be continued this year.

Under this project sugar beet growth is being studied as affected by temperature and an experiment has been set up to study time of last irrigation with respect to harvest.

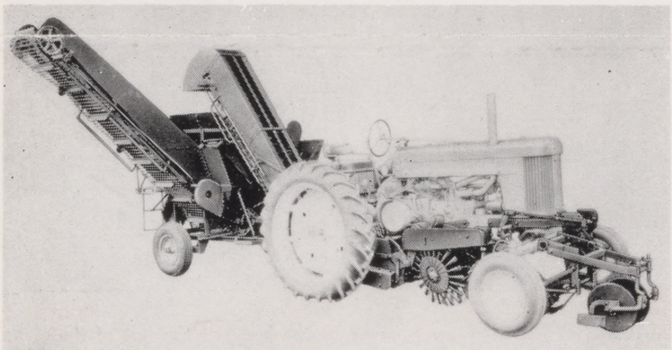
In order that those interested in sugar beets might become better acquainted with this project, a Field Day will be held at Davis on August 7, 1953. On this occasion the field tests underway will be shown and talks presented concerning various phases of the project.

The personnel who are working with this project realize that often the suggestions of growers and industry people can be useful in improving such a program. We are thankful for the past cooperation that has been enjoyed and welcome your continued suggestions and interest in this work.

NEW JOHN DEERE ONE-ROW HARVESTER ANNOUNCED

THE No. 100 John Deere Beet Harvester, pictured below, is designed to top beets in the ground, lift them, clean them, elevate them into a cart where manual sorting of clods and beets may be done, when necessary, and, when the cart is filled, load the beets into a truck. The No. 100 Beet Harvester can be mounted only on Models "50" and "60" John Deere Tractors equipped with wide adjustable front axles and remote cylinder. Sugar beets in any even row widths, 20 through 42 inches, may be harvested with the No. 100 John Deere Beet Harvester provided the tractor is properly equipped. The No. 100 Beet Harvester is not recommended for use in alternate row spacings because tractor wheel spacings cannot be varied to fit different row spacings in the same field.

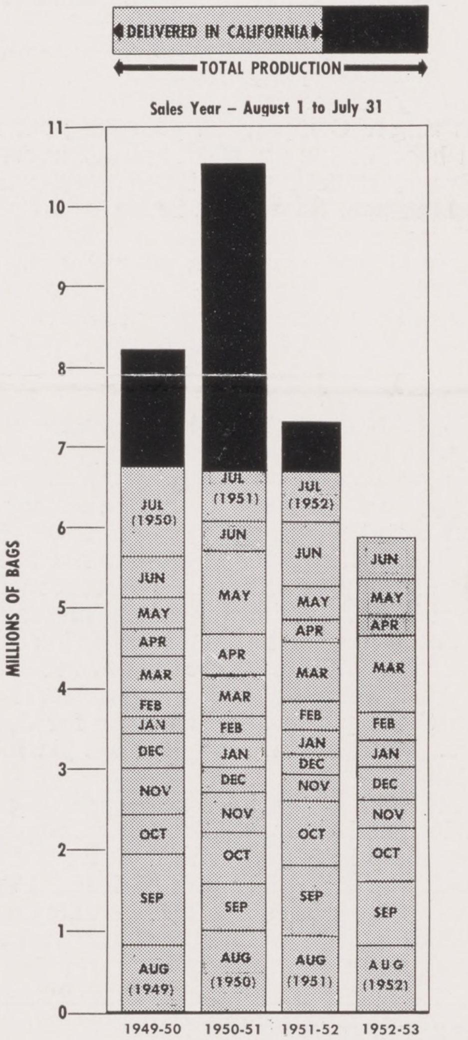
Because of limited production (only 200 units), there will not be any machines distributed in California in 1953. There is a strong possibility, however, that the machine will be made available for California growers in 1954 and subsequent years.



John Deere Photo 54

THE JOHN DEERE No. 100 sugar beet harvester. This is a newly developed one-row machine which tops beets in the ground, lifts and cleans them, and elevates them into a cart where manual sorting of clods from beets may be done when necessary.

PRODUCTION AND DELIVERIES OF BEET SUGAR IN CALIFORNIA



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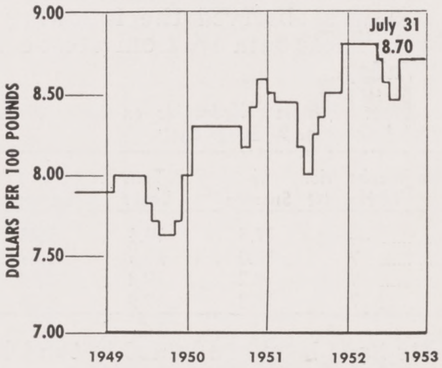
In 100 Lb. Paper Bags, F.O.B. San Francisco



The SPRECKELS SUGAR BEET BULLETIN is issued bi-monthly by the Agricultural Department of the Spreckels Sugar Company as a service to its growers. Mention of specific methods, devices or implements does not constitute an endorsement by the Company. All photographs by the editor unless otherwise indicated.
AUSTIN ARMER, Editor 600 California Fruit Building Sacramento 14, California

SPRECKELS SUGAR BEET BULLETIN

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THE BASIC INGREDIENT

in California's agriculture is an adequate supply of irrigation water.

WHERE TO GET IT
HOW TO STORE IT
WHEN TO MOVE IT

are questions concerning every grower of irrigated crops. See page 34.

Vol. 17 SEPTEMBER - OCTOBER, 1953 No. 5
PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

GROUND WATER IN CALIFORNIA

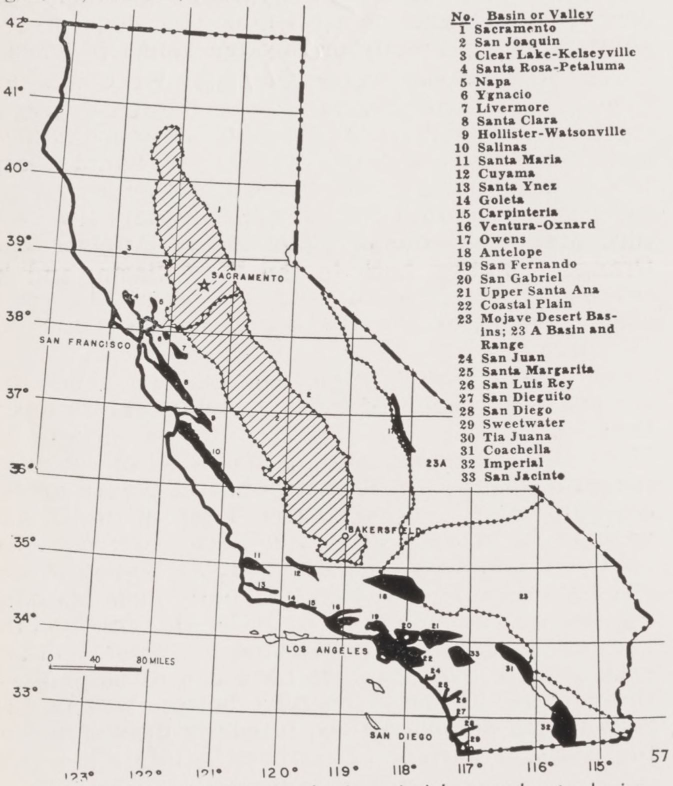
By J. F. POLAND*

THE MAJOR ground-water resources of California occur and are stored in the many large alluvium-filled valleys of the state. The principal ground-water basins are shown on the outline map of California.

The Sacramento and San Joaquin Valleys together comprise the Great Central Valley of California, which has an area of about 18,000 square miles. The Sacramento Valley contains about 5000 square miles of valley lands; the San Joaquin Valley embraces about 13,000 square miles. Both the area and the ground-water use in the Central Valley is far greater than for all the other shaded alluvial basins of the map added together. Except for the Sacramento Valley, all the major ground-water basins of the state are south of Sacramento.

The valley fill in these ground-water basins has been transported by streams and most of it has been laid down in alluvial fans, producing the typical alluvial-fan structure of aquifers radiating as tongues from a pile of coarse, permeable debris at the canyon mouths; these aquifers are encased down slope by poorly sorted materials consisting of a clayey matrix with imbedded pebbles and boulders, interbedded with flood-plain silt. In the deeper inland structural valleys, the alluvial deposits interfinger at depth in the valley bottoms with horizontally bedded sand, silt, and clay. The San Joaquin Valley is a good example. Thus, these water-bearing structures are in a position to absorb stream flow near the canyon mouths and to transmit it through the buried radiating conduits.

*J. F. Poland is District Geologist, Ground Water Branch, Geological Survey, U. S. Department of the Interior, Sacramento, Calif. This article is condensed from a paper published in TRANSACTIONS, American Institute of Mining Engineers, Vol. 187, Feb. 1950.



OUTLINE MAP of California, showing principle ground water basins.

Quantity Pumped and Uses:

Ground-water development in California began in the Los Angeles area a few years after the end of the Civil War, about 1870. By 1900 approximately 10,000 wells had been put down within the four major valleys that comprise the South Coastal Basin. Irrigation north of the Tehachapi Mountains did not become significant until after 1900. By the first World War, in the central as well as the southern part of the state, most of the surface water available from the unregulated streams for irrigation in the dry summer months had been diverted for use. Consequently, most of the development since then has been from the ground-water basins. This has been spurred by the great improvement in turbine pumps and the wide availability of electric power, as well as by expanding population and the increasing demand for agricultural products.

The total amount of ground water pumped yearly from California's underground basins is not known accurately. However, the pumpage from all the basins outside the Central Valley is estimated to be approximately 2 million acre-feet (1 acre-foot = 325,851 gal.) For the San Joaquin Valley, the combined gross pumpage of ground water from about 35,000 wells south of the Merced River for the one-year period from April 1, 1947, to April 1, 1948, was estimated by the California Division of Water Resources from electrical energy consumed as close to 6 million acre-feet. Of this, about one million acre-feet is pumped from the deep wells on the west side of the valley. Pumpage in the part of the San Joaquin Valley north of the Merced River and in the Sacramento Valley together is believed to be nearly two million acre-feet. Thus, the total gross pumpage in the state in the year 1947 to 1948 apparently was between 9,000,000 and 10,000,000 acre-feet. Of this total at least three-quarters was pumped from wells in the Central Valley. These figures suggest that the use of ground water in the state now is roughly equal to that of surface water, including Colorado River water. The pumpage is concentrated almost wholly in the months of little or no rainfall, from April to October. If uniformly distributed throughout the year, the discharge from all well pumps would be equal to about 13,000 second-feet, or about 8.5 billion gallons a day.

A comparison of current ground-water pumpage in California with the flow of main-stem streams and the storage capacity of large surface reservoirs is of use in visualizing its magnitude of draft. For example, the average gauged runoff of the Sacramento River at Red Bluff for the period 1896 to 1939 (water years) is 8,111,000 acre-feet a year. Thus, the estimated current ground-water draft in California is 10 to 20 per cent higher than the 44-year average yearly discharge of the Sacramento River at Red Bluff.

Comparison with the capacity of surface-water reservoirs affords an instantaneous and simpler pic-

ture. For example, the current annual pumpage of ground water is about twice as great as the joint storage capacity of the reservoirs formed by Shasta and Friant Dams.

For the total gross pumpage of ground water, the distribution by major ground-water basins is approximately as follows: Central Valley, at least 75 pct; South Coastal Basin, 8 pct; Salinas Valley, 4 pct; Santa Clara County basins, 3 pct; Ventura County basins, 2 pct; Santa Barbara County basins, 1.5 pct; Antelope Valley and Coachella Valley, each about 1.3 pct; and miscellaneous small basins 1 to 2 pct.

The principal uses of ground water in California are threefold: in order of importance, they are for irrigation, for domestic supply, and for industry.

Problems Created by Intensive Development:

The long-continued and increasing demands on the ground-water supplies of the state have created serious problems in many of the ground-water basins. In some of the basins, water levels have been drawn down many scores and even hundreds of feet; in a few coastal basins the drawdown has pulled water levels many feet below sea level. The principal problems created by this great lowering of water levels and the application of large quantities of ground water and surface water to irrigation of the agricultural lands are those of (1) overdraft, (2) saltwater encroachment, (3) gradual changes in the chemical and physical character of the soils, and (4) long-term changes in the chemical character of ground waters. Only the first two are considered here. Protection of the ground-water supplies from pollution by industrial wastes has become a very important problem in recent years, owing to the great increase in industrial plants and somewhat indiscriminate disposal of wastes. That problem, which is now under investigation by several state agencies, has developed primarily because of rapid industrial expansion.

Overdraft:

Prolonged and progressive drawdown of water level in a ground-water basin suggests an overdraft, that is, that the average net draft is exceeding the average replenishment. Such a condition is more noticeable if the depth to water is rapidly approaching the economic limit of pumping or if the drawdown is dewatering a substantial part of the saturated thickness of water-bearing beds.

In California, the problem of overdraft is complicated by the distribution of rainfall, which is the most basic factor in recharge. Not only is the rainfall concentrated almost wholly in the months from October to May, but also it varies greatly from year to year and has a rude cyclical distribution, with periods of many years in which the average rainfall is deficient and others in which it is above normal. For this reason both recharge and draft fluctuate not only from year to year but from period to period.

In at least a dozen areas in California a condition of real overdraft now exists. The largest is the San Joaquin Valley. Here the areas of overdraft on the east side are chiefly south of the Kings River recharge area, south of Hanford and Visalia. In this area the overdraft probably is within the range of half a million to a million acre-feet a year. On the west side of the valley, for the 150-mile strip from Mendota to the south end, development of ground water has taken place largely since 1935 and has been most rapid since the early forties. Here the gross pumpage is now on the order of a million acre-feet and probably more than half of the water consumed is being mined. Compared to the discharge of Sierra streams to the east, the flow of the west side streams is very low and recharge is small.

Other large basins of the state which are now reported as or known to be overdrawn are the Santa Clara Valley fringing San Francisco Bay; the lower east side of the Salinas Valley; the Santa Maria Valley; the Ventura-Oxnard area; the Antelope Valley; the Upper Santa Ana Valley; and the main and West Basins of the coastal plain, which are in the South Coastal Basin.

Salt-water Encroachment:

Several of the major and at least a dozen of the minor ground-water basins of California border the coast and their seaward margins are in contact with or extend beneath the Pacific Ocean or its landward salients such as San Francisco Bay. Geologic and hydrologic evidence accumulated to date show that in these basins the seaward ends of the aquifers are in hydraulic contact with the ocean. Under natural conditions of seaward hydraulic gradient, fresh ground water was discharged to the sea or to its inland extensions. In places along the coast where heavy pumping has drawn down the water level below sea level, the hydraulic gradient has been reversed and ocean water has invaded the aquifers either directly or through defective wells.

In this way, salt water has invaded to some degree ground-water basins in the following areas: the Sacramento-San Joaquin delta between Antioch and Pittsburg; the Napa Valley; the Santa Clara Valley from Oakland on the east to San Mateo on the west; the mouth of the Salinas Valley; the Ventura area; the coastal plain of Los Angeles and Orange Counties, both in the West Basin, and in the main coastal basin; and several of the small coastal basins of San Diego County, especially the Tia Juana Valley.

In several basins, saline contamination has developed by invasion of interior saline waters apart from the ocean. For example, in the vicinity of Marysville in the so-called peach bowl of the Sacramento Valley it is reported that at places excessive drawdown of the water level in wells has brought in saline water from local sources. Also on the west side of the San Joaquin Valley in the vicinity of Vernalis and to the south, beds containing saline waters locally underlie the fresh-water aquifers. Wells which penetrated too great a thickness of water-bearing beds have had to be plugged so as to seal off the undesirable bottom waters. Locally in the Salinas Valley, intensive draw-down of the pressure surface in confined aquifers has per-

Continued on Page 40

THE PROBLEM OF VOLUNTEER BEETS

By DR. RUSSELL T. JOHNSON
Plant Breeder, Spreckels Sugar Company

RECENTLY our attention has been brought to a weed problem in some of our beet growing areas that is serious in some localities and may become serious in others in the not-too-distant future unless some precautions are taken. The "weed" involved is the volunteer beet. A weed is defined as any plant growing out of place, thus a beet growing any place except a beet field becomes a weed.

For a long time we have known of several areas in California infested with a so-called "wild beet", which is an annual and seeds very abundantly. These are widespread around Hollister, Milipitas-San Jose, sections of the Imperial Valley, and a few other places. Their exact origin is not known but it has been speculated that they are descendants of beets used as vegetables by early settlers in California and have since evolved into annuals.

More recently annual beets have appeared in other sugar beet growing areas. It is possible that in some of these cases a few stray beets from commercial varieties have been left along fence rows, ditch banks, as volunteers in succeeding crops, etc.; and that descendents of these have reverted into annuals.

Just how long it takes a beet to evolve from a biennial to an annual is not known and would probably vary from one beet to another. Every pressure exerted by natural selection would encourage this process. Any beet capable of germinating during the winter rains and rapidly producing seed the next spring while sufficient moisture for growth was still available could easily reproduce itself. A beet not capable of going to seed so readily would probably be destroyed by cultivation or drouth. Thus the first to produce seed survives, which means those which are either annuals or most closely approach being annuals.

These annual beets are thrifty and highly competitive with other weeds. Fig. 1 shows how these beets become established in uncultivated areas.

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Fig. 1. Wild beets along a railroad right-of-way, showing how they tenaciously persist as weeds in competition with other weeds.

The problem created by these beets in a commercial field is fairly obvious; at thinning time most of these annual beets cannot be differentiated from the intentionally planted biennial beets, and a few weeks after thinning they begin to produce seed stalks. Very few of these beets produce a marketable root. Fig. 2 shows what happens when these volunteer annuals are left at thinning time. These two beets were taken from the same field at the same time. The annual on the right, immediately after thinning began to produce a seed stalk and never did produce a satisfactory root, while the beet on the left is a normal sugar beet of good size. It is easy to see why a field with very many of the annual beets could not produce a satisfactory crop.

Fig. 2. Comparison of two beets from the same field. Beet at left is a normal sugar beet. Beet at right is a volunteer annual. Both beets looked alike at thinning time, but shortly thereafter the annual started developing a seed stalk.

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A few fields of beets were planted, thinned, and fertilized before it was realized that there was a tremendous number of these annuals in the fields, in some cases over fifty per cent. Such fields cannot possibly produce a profitable crop.

The danger from these annual beets is more than just the scattering of the seed they produce. In many of our commercial fields, especially those planted early, there are some plants which bolt and produce seed. If the perimeter of the field is infested with annual beets, chances are good that most of these bolters in the commercial field were pollinated by the annuals. The annual character is inherited as a dominant factor, so offspring from the bolters in commercial fields pollinated by these annuals would be entirely annual. Thus it becomes a vicious circle, rapidly increasing the problem.

In areas of intensive row crop farming, where irrigation water comes from wells on the farm, this problem is not likely to become too serious because volunteer beets emerging in a field of lettuce, tomatoes, cotton, or similar crop would be destroyed before going to seed when good farming practices are followed. These volunteer beets are more likely to cause troubles in grain, hay, pasture, and particularly along the banks of ditches which are used for irrigation. In grain fields many of these volunteer beets produce viable seed before the grain is harvested. This beet seed, being light in weight, is blown out of the harvester with the chaff and straw and in this manner further scattered. In hay fields the mowing machine prevents some seed formation; however, there are many of these plants which branch below the level of the cutter bar and produce seed unhampered. Fig. 3 shows an example.

Fig. 3. Seed developing on an annual beet after the main stem had been cut off by a mowing machine. The pointing hand indicates the height at which the main stem was cut. Branches growing below the level of the cutter bar produce seed unhampered.

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Fortunately, in most of our areas these volunteer beets have not become annuals yet and do not constitute a serious problem at the present time; however, they do represent a situation which could become very serious in the foreseeable future. Spring harvest of sugar beets, which seems now to have become an accepted practice in some areas, should make us more aware of this condition. Some viable seed may be produced on some plants if harvest continues late into the spring. Also, crowns from overwintered beets will produce seed that same year if growing conditions are favorable and they are not destroyed by tillage in preparation for the growing of another crop. On a recent trip in the Woodland area, I observed seed being produced in one location from crowns of beets that were harvested this past spring.

A case history might be cited for a farm on which volunteer beets, which have reverted into annuals, have definitely become a problem. On a field near Woodland, some bolters began to appear in a portion of the 1953 crop of beets shortly after thinning. A check of this crop history of that field gave an explanation for the results observed. Following is a crop record of that field for the past six crops:

1948—Sugar Beets.
1949—Barley.
1950—Sugar Beets. (Approximately one-half of the field was harvested in the fall of 1950, the remainder was carried over and harvested in the spring of 1951).
1951—Barley. (On the portion of the field that was fall harvested and fallow on the spring harvested portion. No weed control was practiced on the fallowed ground.)
1952—Barley. (No chemical weed control used.)
1953—Sugar Beets (Volunteer beets appeared in the area that was carried over into the spring of 1951.)

It should be noted that only one-half of the 1950 crop of beets was harvested in the fall, the remainder being carried over the winter and harvested in the spring of 1951. In all probability some of these overwintered beets had bolted sufficiently early to produce viable seed before they were harvested in 1951. During the growth of the 1952 barley crop (seeded in the fall of 1951), much of this beet seed germinated during the winter, produced seed stalks early the following spring in the barley field, and developed viable seed before the barley was harvested. This seed was apparently scattered over the field to the extent that when beets were seeded in 1953, many of these volunteers came up in the seeded row and were left at thinning time. On the portion of the field on which the 1950 crop of beets was harvested in the fall of 1950, there were only a few bolted beets in the 1953 crop.

Fig. 4 is a photograph of the one portion of this field, showing the large number of seed stalks produced in the present crop of beets. A serious reduction in tonnage is the result of such a heavy infestation of these volunteer beets.

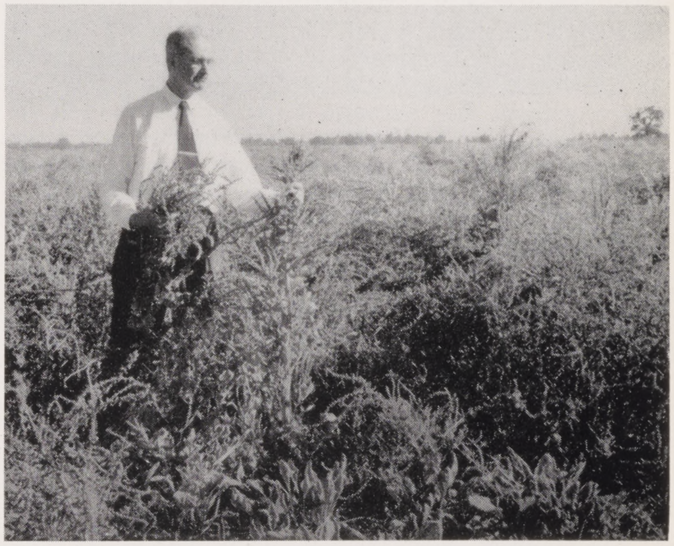

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Fig. 4. A portion of a commercial field of beets in which a great many volunteer beets have gone to seed. Some of the intentionally planted beets can be seen in the foreground, and these are not producing seed stalks.

The following are a few suggestions that may be of use in arresting this situation before it becomes more widespread than it is:

1. Encourage field labor, irrigators, etc., to chop out the beets from ditch banks, fence rows and areas where they are unwanted.

2. Where grain follows beets and many crowns took root and began to grow, apply a spray for dicotyledonous (broadleaf) plants. If this is done in the spring, it will kill the crowns producing seed stalks. Any beets emerging from seed of bolters the previous year will not produce seed the current year, but will be destroyed with the straw from the grain crop.

3. Where many bolters and viable seed develop in a commercial crop of sugar beets, follow it with a crop that can be cultivated or sprayed to prevent weeds for at least one year. If a hay crop immediately follows a beet crop where much viable seed was produced, the removal of the volunteer beets is difficult. The mowing machine will undoubtedly remove many of them, but there will probably be some which will go to seed.

4. Keep other row crops free from volunteer beets, as well as other weeds.

In areas now infested with annual beets, do not follow beets with beets. Plant beets on ground that has been in a row crop the previous year.

WILL THERE BE ACREAGE QUOTAS?

By GUY D. MANUEL

Vice President and General Agriculturist, Spreckels Sugar Company

Since 1951 sugar beet acreage throughout the nation has been undergoing a gradual annual increase. This trend has been proportionately greater in some areas than in others, and California has been one of the producing areas experiencing a greater-than-average rate of increase. For example, the 1953 sugar beet acreage for the United States as a whole, represents a 5% increase over 1951, while California has increased 15% in the same period. This trend might be expected to continue for several years, except for acreage curtailments which become necessary to maintain beet sugar production in line with the marketing allotment permitted under the Sugar Act. Already the Department of Agriculture has placed acreage restrictions on Louisiana and Florida cane growers for the 1954 crop.

Even at this early date the outlook for acreage in 1954 appears to be much higher than for 1953. With this outlook it is reasonably certain that acreage allocations would be imposed by the federal government for 1955 plantings. Why no allocations of acreage in 1954? Because there is little justification for acreage restrictions until beet sugar marketings in any one calendar year have actually reached the allowance of the Act.

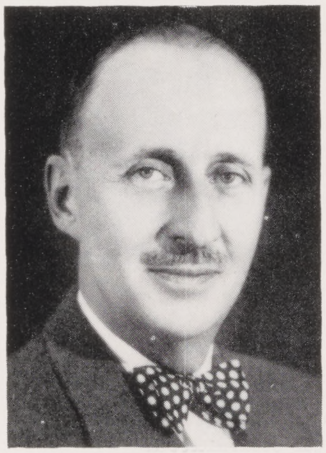
The Sugar Act of 1948, as amended, guarantees the U. S. sugar beet farmer and processor the marketing of a certain portion of the annual U. S. consumption of sugar. The Act states that the domestic beet producer shall receive a share not to exceed 1,800,000 short tons, raw value, of the total sugar marketed within the United States. The balance of the sugar consumed annually, about 6,200,000 tons in 1952, comes from domestic cane producers and from such offshore producers as Cuba, Phillippine Islands, Formosa and others. When the domestic beet sugar areas produce less than their share of the market, the shortage is apportioned to these other producers. However, when the U. S. beet growers and processors produce over their marketing quota under the Sugar Act, the application of certain restrictions may become necessary.

The first action of the Secretary of Agriculture, when over-quota beet sugar is present, is to place market restrictions upon the processors. As a means of controlling marketing, the Act empowers the Secretary to restrict production through beet acreage limitations. Consequently, the restriction of sugar beet acreage to growers usually follows market restrictions on the processors when the trend is toward a high level of sugar beet plantings.

The 1952 sugar beet crop produced refined sugar equivalent to 1,508,000 short tons raw value. This current crop is expected to yield in excess of 1,700,000 short tons. The acreage expected in 1954 is estimated to result in beet sugar production considerably exceeding the statutory quota of 1,800,000 short tons. It is almost certain, therefore, that the processors will be restricted in marketing in 1954 and likewise, if sugar beets remain a popular crop, beet acreage will be restricted in 1955.

While it is not possible at this time to predict the method by which the Department of Agriculture might limit acreage, it has been customary to use a proportionate-shares method of allocation to assure each farmer his fair share of the beet sugar produced. Grower history and land history of sugar beet production are both certain to be given weight in any formula which may be developed.

WHARTON K. GRAY



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WHARTON K. GRAY

On August 28, Wharton K. Gray, vice-president in charge of operations, died suddenly in San Francisco. Mr. Gray had been away from his desk since May as a result of a heart attack. He had been making progress toward recovery when he was stricken with a second and fatal attack. He was fifty-six years old.

Mr. Gray's professional life was one of continuous preparation for the high position he ultimately reached. A native of Denver, he took his engineering degree from the University of Colorado in 1919 following his military service in World War I. His subsequent career has always been allied with the beet sugar industry, either as an employee of processors or with manufacturers of equipment for the beet sugar industry.

In 1933 Mr. Gray joined the Spreckels Sugar Company and was assigned to the Spreckels factory as an efficiency engineer. Two years later he was called to the San Francisco office and promoted to mechanical engineer, in which position he did important work in designing and erecting the Woodland factory. His performance on this job won him further recognition; in 1937 he was named chief engineer of Spreckels Sugar Company.

In 1943 he was officially designated purchasing agent and chief engineer, and continued to act in this dual capacity for the next six years. Mr. Gray's promotion to vice-president in 1949 was a logical step along a path that had begun 30 years earlier. In this position he was in charge of the three factories and supervised the engineering department, the purchasing department, and the company's industrial relations. He performed the duties of this office until his illness in May.

Mr. Gray's professional accomplishments are attested by his membership in the American Society of Mechanical Engineers, the California Society of Professional Engineers, the American Society of Military Engineers, the Engineers Club of San Francisco, the San Francisco Chamber of Commerce, the Purchasing Agents Association, and Sigma Nu Fraternity.

NEW TWO-ROW MARBEET HARVESTER IS DEVELOPED

The Blackwelder Manufacturing Company has had a radically new two-row Marbeet harvester on its Engineering Department drawing boards for several years. A prototype machine based on this paper work has completed its field tests and will be available if quantity production is justified by the demand. Inquiries should be directed to the Blackwelder Manufacturing Company, Rio Vista, California

Features of the machine which differ radically from the older two-row models are:

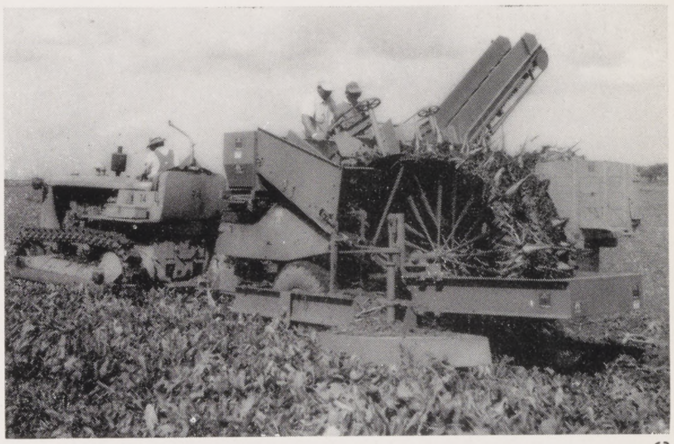
(1) Row spacing adjustment from 12″ to 30″

(2) Reduced draft (The stinger has been replaced by two small forward plows.)

(3) Filter rolls have been eliminated.

(4) Beets are diverted outwardly from the pick-up wheels

(5) Ample clearance for foilage and weeds. eliminates clogging.



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THE NEW two-row Marbeet harvester

Advantages claimed for the new machine are reduced draft, complete beet recovery without breakage, and generally improved dependability and operator comfort.

UNIVERSITY AGRICULTURAL PUBLICATIONS AID SUGAR

THE UNIVERSITY of California publishes the findings of its experiment stations and distributes these findings through the Extension Service. There are a great many bulletins and circulars available to the sugar beet grower which are real nuggets of information, relating either directly to the growing of sugar beets or to general farming practices of interest to the beet grower.

These valuable publications can be obtained from your County Farm Advisor or by writing to:

Publications Office
College of Agriculture
University of Agriculture
Berkeley 4, California

A list of the bulletins and circulars of particular interest to sugar beet growers follows:

Title	Author	Number
AQUATIC AND DITCHBANK WEEDS	Alden S. Crafts	Circular 158
THE BORDER METHOD OF IRRIGATION	James C. Marr	Circular 408
ECONOMIC FACTORS AFFECTING THE SUGAR BEET INDUSTRY	J. M. Tinley	Circular 413
FEEDING VALUE OF SUGAR BEET BY-PRODUCTS	Guilbert, Miller and Goss	Bulletin 702
FERTILIZERS FOR SUGAR BEETS ON SOME CALIFORNIA SOILS	Pendleton and Robbins	Bulletin 694
IRRIGATION PUMPS—THEIR SELECTION AND USE	C. N. Johnston	Circular 415
IRRIGATION WELLS AND WELL DRILLING	C. N. Johnston	Circular 404
LAND DRAINAGE	Walter W. Weir	Circular 391
SILAGE, SILAGE CROPS AND SILOS	Smith and Davis	Circular 411
SPRINKLING FOR IRRIGATION	F. J. Veihmeyer	Circular 388
VIRUS DISEASES OF SUGAR BEETS	Sylvester and Severin	Circular 422

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F. H. BALLOU, JR. NOW VICE-PRESIDENT IN CHARGE OF OPERATIONS

F. H. Ballou, Jr. has been appointed a Vice-President of the Spreckels Sugar Company. He will be in charge of the company's factory operations and will continue to make his headquarters at the San Francisco office at 2 Pine Street.

Mr. Ballou's promotion will fill the vacancy caused by the recent death of Wharton K. Gray, the former Vice-President in charge of operations.

Mr. Ballou has been associated with Spreckels Sugar Company for sixteen years. He has served successfully as Junior Engineer, Mechanical Engineer, Development Engineer, and Chief Engineer. Last July he was named as direct assistant to the late Mr. Gray.

GROUND WATER Continued from Page 34)

mitted saline shallow waters to move down and contaminate the fresh waters beneath.

Methods for Increasing the Available Supply:

There are only two possibilities for decreasing or eliminating an overdraft: (1) decrease the net discharge, or (2) increase the recharge.

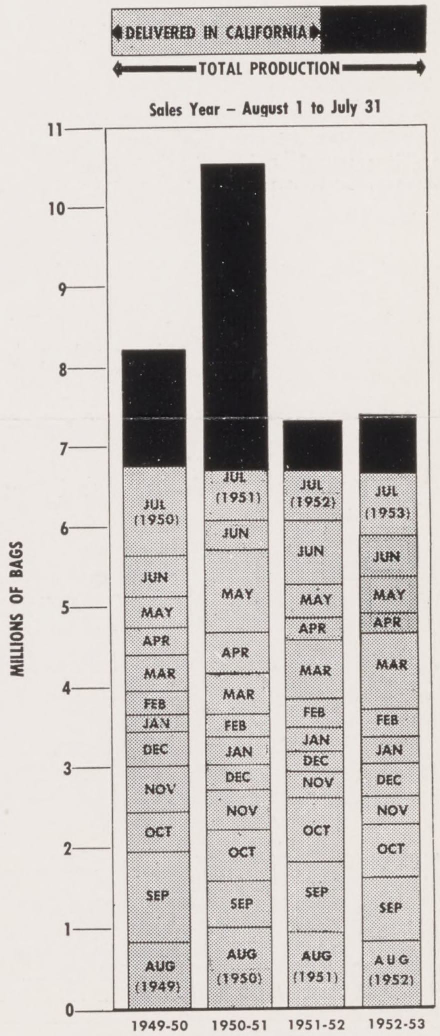
The only means of reducing net discharge is by decreasing pumping draft. This never will be a popular action and probably never would succeed unless supported by legal authority or enforced by economic necessity.

Fortunately, the recharge ordinarily can be increased substantially by conservation measures, by catching the runoff in detention reservoirs and spreading it on permeable deposits so that it will go into storage in the ground-water basins. In some basins, however, it is too costly to retain much of the flash runoff in surface retention dams. In such cases, importation of water is the only means for supplementing the ground-water supply.

In connection with the problems of overdraft and need for additional water in many of the ground-water basins of the state, a reappraisal of the over-all water resources is now under way by the State Water Resources Board through the Division of Water Resources. The primary purpose is to determine where surplus waters exist, how great they are, and how they can be utilized to best advantage in areas of deficient supply. In the future, the steps which are taken to increase or protect the supplies of ground water in California doubtless will result in a great increase in the quantities of water placed in cyclic ground-water storage, and necessarily will require much research on methods and techniques of artificial recharge. As a prerequisite to effective progress, the geology and hydrology of the critical ground-water basins should be examined in detail.

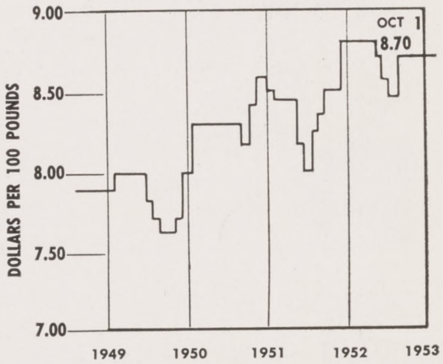
Editor's Note—This is the first of two articles presenting the problem of California water supply. The second article is in preparation and will be published in the near future.

PRODUCTION AND DELIVERIES OF BEET SUGAR IN CALIFORNIA



QUOTED PRICE OF BEET GRANULATED SUGAR

In 100 Lb. Paper Bags, F.O.B. San Francisco



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All photographs by the editor unless otherwise indicated.
AUSTIN ARMER, Editor 600 California Fruit Building Sacramento 14, California

SPRECKELS SUGAR BEET BULLETIN

66

SPRING HARVEST

of overwintered sugar beets by Spreckels growers is entering its fourth year.

MORE SUGAR PER ACRE

EXTENDED PLANTING SEASON

FREEDOM FROM WEATHER HAZARDS

are some of the advantages offered by overwintering sugar beets. See page 42.

Vol. 17 NOVEMBER - DECEMBER, 1953 No. 6

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

PLANTING DATES FOR SPRING HARVEST

By LAUREN BURTCH
Agronomist, Spreckels Sugar Company

SPRECKELS' GROWERS in the Sacramento and San Joaquin Valleys have added two new terms to their vocabularies — overwintering and spring harvest. These terms originated in the spring of 1951 when it was necessary, because of early fall rains, to hold over a sizeable acreage of beets for spring harvest. Overwintering was successfully repeated with the 1951 and 1952 crops and is now being regarded as a good insurance policy against harvesting beets in the winter mud.

As a natural outgrowth of spring harvest, growers have been planting later in the spring and early summer.

ADVANTAGES OFFERED BY SPRING HARVEST

Before the advent of overwintering and Spring harvest, sugar beet growers were committed to a pretty tight schedule between planting and harvest dates.

Planting early enough to bring beets to maturity for fall harvest was not always permitted by weather conditions. Late winter rains sometimes forced the postponement of planting until April, or even May. The resulting crop had to remain in the ground as long as possible in order to yield well, with the consequence that its harvest late in the fall was endangered by rainy weather, and the prospect of costly harvesting in the mud.

But the option of overwintering offers the grower relief from these hazards, and in addition, may contribute a substantial gain in yield at harvest time. The grower should take advantage of breaks in the late winter rainy season, and plant with the intention of harvesting in the early fall. (This program must of necessity be followed by a majority of growers in order to provide beets to start and maintain the fall campaign of the factories). However, if local soil and weather conditions should delay planting until April or May, or if replanting becomes necessary, the grower may proceed in an orderly manner, confident that his crop can be carried through the winter, and be harvested in the spring after fully maturing.

One word of warning—do not let beets scheduled for overwintering suffer for want of water in the fall. Once committed to a program of spring harvest, the grower must maintain moisture and fertility until winter rains take over the job of irrigation.

YIELD DATA

In an attempt to measure the growth and sugar percentage increases that might be expected during the cold months of December, January and February, a number of beet fields were selected last fall for periodic sampling through the winter.

The results of this sampling study are shown in Tables 1 and 2. Each of the figures in Tables 1 and 2 represent the average of five fields selected in the

TABLE 1
YIELD OF BEETS IN TONS PER ACRE AS AFFECTED BY PLANTING AND SAMPLING DATES IN 1952

PLANTING DATE	DATES OF SAMPLING December	January	February	March
May	26.4	25.8	28.0	28.0 (Harvested)
June	18.6	17.8	21.2	21.0
July	10.4	11.9	12.9	13.2
August	6.4	8.2	9.3	10.4
September	1.4	3.4	3.9	5.9
MEAN	12.6	13.4	15.0	15.7

TABLE 2
SUGAR PERCENTAGES AS AFFECTED BY PLANTING AND SAMPLING DATES IN 1952

PLANTING DATE	DATES OF SAMPLING December	January	February	March
May	15.66	15.93	17.12	17.12 (Harvested)
June	14.62	15.29	16.17	16.34
July	14.34	14.74	16.48	15.60
August	14.02	14.06	15.98	15.33
September	10.46	11.33	13.42	13.46
MEAN	13.82	14.27	15.83	15.57

region from Tracy north to Marysville. Six samples were taken from each of the 25 fields on four dates between December 1 and the middle of March. Table 1 shows that the May-June planted beets were good crops at spring harvest time, and tended to increase in tonnage during the winter months. The sugar percentage for these May-June fields showed a consistent increase (Table 2) with each field average increasing from December through February.

The same trend in the increase in tonnage and sugar percentage occurred in a number of April and May planted fields. These fields were partially harvested in the fall and completed in the spring. For example, one late May planted field in the Lodi area was averaging 20 tons in the fall with 14.7 sugar and finished up in the spring with 22 tons and 17.7 sugar. This field was irrigated in October and was still green when harvest started in November. When rain stopped the harvest, the field was left in ideal condition for overwintering.

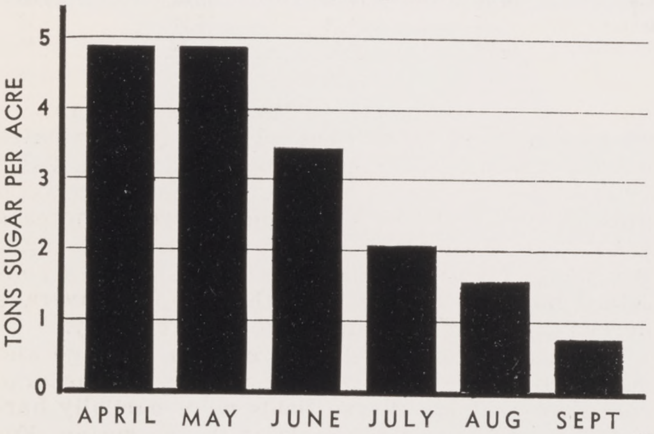
Other fields planted about the same time showed similar although smaller gains in sugar percentage. The increases in individual fields were reflected in the factory average which showed an increase of 0.7 sugar in percent between fall and spring harvest for the 1952 crop. These results, plus growers' experience in 1950-51 and 1951-52 make spring harvest beets appear to be the most profitable means of getting the maximum return from a late spring planted crop of beets in the Sacramento and northern San Joaquin Valleys.

PLANTING DATES IN THE SACRAMENTO AND NORTHERN SAN JOAQUIN VALLEYS

In addition to the April, May and June plantings in the Sacramento and northern San Joaquin valleys, planting dates extending into July, August and early September were tried by a number of Spreckels' growers. It is evident from Table 1 that plantings made after June did not make satisfactory crops for spring harvest. It is this rapid decline in tonnage as the planting date is delayed past June

that pretty well determines the latest profitable planting date. While a July or August planting permitted beets to follow grain, there was not sufficient good growing weather to produce a satisfactory crop between July 1952 and April 1953 in this region. Table 1 shows that some growth did take place through the winter but this growth was not enough to overcome the lack of a long summer. It is also evident from Table 1 that the later the planting date, the lower the yield, and that the line dividing a good crop and a poor crop lies between June and July. The sugar percentage (Table 2) shows the same consistent increase through the months of December, January and February that it did for the May-June plantings.

The bar chart below shows how seriously sugar-per-acre production (at harvest time in March) drops as the planting date is delayed past June.



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PLANTING DATES later than the first of June produced a rapid decline in harvested sugar per acre in the Sacramento and Northern San Joaquin Valleys.

PLANTING DATES IN THE SOUTHERN SAN JOAQUIN VALLEY

In addition to the fields planted in the northern region, several fields in the southern part of the San Joaquin valley were planted in the late summer of 1952 for spring harvest. Most of the fields were planted in September and were harvested at the close of the spring harvest campaign. The results were encouraging in spite of a premature harvest made necessary by the bolting tendencies of present varieties. To be completely practical, these plantings will require a variety of beets which will be resistant enough to bolting to grow through a winter in the San Joaquin without producing a high percentage of seed stalks the following spring. There are indications that such a variety will be developed. This type of planting would fit the rotation program of a large portion of the southern San Joaquin valley where there is a seasonal water shortage in June, July and August, but adequate water from September to May.

The 1953 experimental plantings in the southern San Joaquin Valley were harvested in April, before bolting became serious. Their yields were appreciably higher than those from crops planted as much as 60 days earlier in the Sacramento Valley.

There was substantial evidence that truly late plantings (throughout September, for example) can become profitable in the southern San Joaquin Valley, particularly in the case of varieties with high bolting resistance. If September plantings could be harvested in June, these beets would be out of the way in time to start the July harvest of early spring plantings—affording a continuous factory operation from June through December.

The Spreckels seed breeding program is aimed at producing varieties to make such a program possible, and these exploratory experiments are showing real promise.

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THESE BEETS were planted near Huron on September 15, 1952. This photograph was taken on April 9, 1953, five weeks before harvest.

SUMMARY AND CONCLUSIONS

Grower and Company results from the past three years show that spring harvest beets (planted in April, May, and June) may be safely and profitably overwintered in the Sacramento and northern San Joaquin valleys in any area not subject to excessive seepage or flooding. The crops that have entered the winter in good condition (with some residual nitrogen and moisture) have consistently gained in tonnage and sugar per acre by overwintering. Late planted beets (beets planted after July 1) have not produced satisfactory spring harvest crops in the Sacramento and northern San Joaquin valleys. Late planted beets have however, showed promise of becoming economically profitable crops in the southern San Joaquin valley.

There is every indication that spring harvest beets are here to stay — not only as insurance against premature shut down of fall harvest because of bad weather — but also as a promising method of getting the maximum return from a late spring planting.

RESOURCEFUL BEET GROWERS CONTRIBUTE TO MECHANIZATION

By AUSTIN ARMER
Agricultural Engineer, Spreckels Sugar Company

CALIFORNIA FARMERS have a well-earned reputation for inventiveness, and beet growers are no exception.

This year the roundup of grower ideas aimed at improving the tools of their trade reveal some clever developments which might well inspire other beet growers.

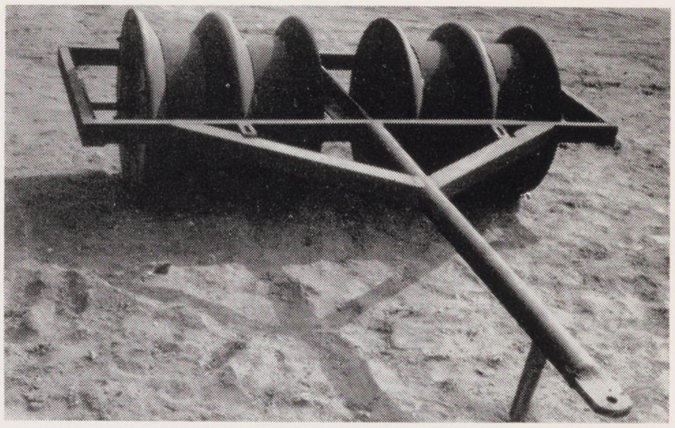
Schween Brothers of Salinas have developed a neat and practical aid to irrigating beets for germination. Instead of filling the main furrows to capacity in order to merely dampen the soil on top of the beds, Schween Brothers roll a small furrow into the top of each bed. By trickling a small stream of water into the little furrows, the water is immediately available to germinate the seed, yet the soil beneath the beds remain unsoaked by excess moisture.

Joe Garsino of Linden must have broken some sort of record for economy in harvesting his beets during the 1953 campaign. He purchased a Marbeet Jr. and a Caterpillar R. D. 4 Tractor — both at junk prices and in junk condition. With his own hands he restored both the harvester and the tractor to prime condition — and furthermore, he rigged the tractor controls so that he could operate them all from the tractor seat, and eliminate the need for a harvester operator. A hydraulic pump on the tractor power take off actuates the lift cylinder on the harvester, replacing the regular pump on the harvester.

Robert Farnsworth of Grimes has contributed a number of improvements to his big two-row Marbeet Harvester. In order to get through heavy weeds and trash, he arranged a pair of coulters astride the tongue of the harvester. These are lifted by their own hydraulic cylinder. Then he designed a stinger plow which not only prevents root-breakage, but also reduces draft. To handle the extra hydraulic load he installed a high capacity vane-type pump and a set of finger-tip control valves.

Richardson Brothers of Hollister designed a beet bed for trucks which has several important advantages. They replaced the head and tail boards with expanded metal screen, braced with small channel iron beams. This has the advantage of permitting the driver to watch the load as it builds up from the harvester. It has the further advantage of markedly reducing wind resistance when driving the truck empty.

C. D. Goodwin of Stockton grows a lot of beets in the Collegeville area near Manteca. He also has a profitable cattle-feeding project to utilize his beet tops. To recover his beet tops, he first rakes them into windrows with a tractor-mounted side-delivery rake following his Marbeet Midget harvesters. The windrowed tops are then picked up and delivered to trucks by a Wiebe Loader built by the Wiebe Manufacturing Company at Hollister.



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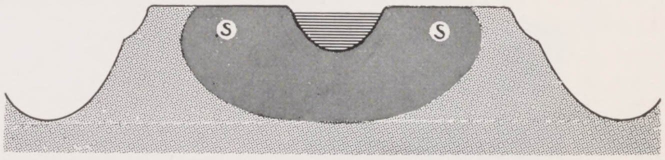
SCHWEEN BROTHERS built this bed roller for pressing into the center of the bed an "irrigating-up" furrow.



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A CROSS SECTION of the rolled bed shows how a little water in the small central furrow dampens all of the soil around the seed rows (S, S).

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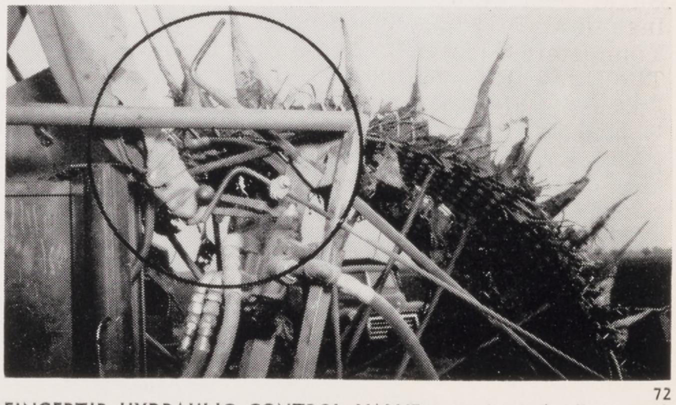
JOE GARSINO operates his Marbeet Jr. Harvester single-handed. A hydraulic pump on the tractor together with extended harvester controls eliminates the need of a harvester operator.



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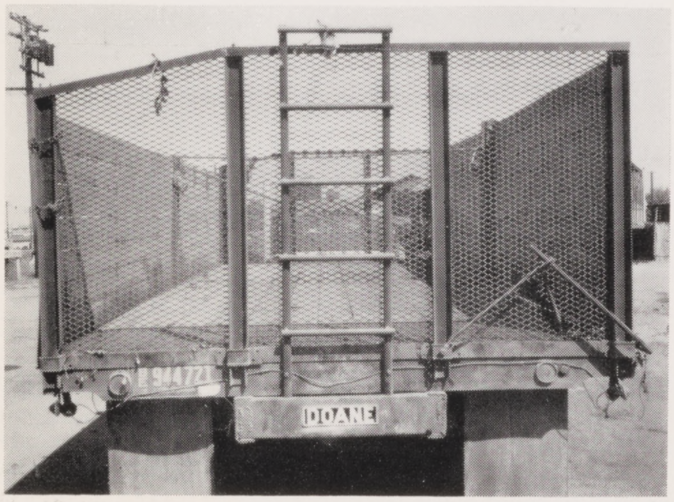
FINGERTIP HYDRAULIC CONTROL VALVES speed up the Farnsworth Harvester's operation.

73
ROBERT FARNSWORTH designed these hydraulically lifted coulters for his two row Marbeet Harvester.

74
THIS STINGER PLOW on the Farnsworth machine resembles a middle-buster. It reduces draft and root breakage.



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RICHARDSON BROTHERS built this beet bed with expanded metal head- and tail-boards. They cut wind resistance and permit the driver to watch the loading of the truck.

MOTION PICTURE FILMS AVAILABLE

SPRECKELS SUGAR COMPANY has produced two 16 mm sound films dealing with various phases of sugar beet culture. These films had their premiere at the Annual District Meetings of the California Beet Growers Association.

"More Sugar Per Acre" describes all of the steps in breeding, growing, and processing sugar beet seed.

"Springtime in the Beet Fields" describes the theory and practice of Spring Mechanization. Rotary Cultivators and down row thinners of various types are shown at work.

Running time is approximately one-half hour for each film.

Both films are now available for general public exhibition before interested groups such as farm center meetings, 4-H Clubs, High School Agricultural classes and Service Clubs.

Address requests to Agricultural Department, Spreckels Sugar Company, 2 Pine Street, San Francisco, California.

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C. D. GOODWIN windrows the beet tops left by his Marbeet Midget Harvester, using this tractor-mounted side-delivery rake.

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AFTER WINDROWING, the tops are picked up by a Wiebe Loader.

PRE-PLANTING WEED CONTROL ON SUGAR BEET BEDS

By WARREN WESTGATE
Standard Agricultural Chemicals, Inc.

FIVE YEARS AGO, due to the investigations of Professors Robbins and Bainer, sugar beet growers showed an interest in the possibilities of spraying sugar beet beds with low volumes of dinitro-fortified weed oils. In the early experiments the application was made at the time of planting or just after planting and prior to the emergence of the beets. This type of weed control was then termed "pre-emergence" spraying. Pre-emergence sprays as such, however, did not prove practical. The application had to be done in exactly the right time, and the right time was often during the rainy weather, which either prevented the application entirely or delayed it until too close to the emergence of the beets to be safe. However, like many other good ideas, after some of the "bugs" were removed, something profitable came out of it. As a result, pre-emergence spraying is now more properly called "pre-planting" spraying. The application is now made not after planting, but several weeks before planting. Last winter some three thousand acres of sugar beet beds in the Davis-Dixon area were so treated. The applications were made after the beds had been listed up, and BEFORE planting time. The method has proved to be practical and safe.

Due to increasing popularity of the program, the 1949 experiences of Everett and Tommy Kunze, Davis beet growers, might well again be related. (Spreckels Sugar Beet Bulletin, Nov.-Dec., 1949) They had fields with beds formed and ready to plant as soon as dry enough. But fall rains and warm weather brought up a lush growth of barley and wild oats, and promised to grow out of hand before anything could be done about it. Of course, when the fields became dry enough they could be disked. This, however, would have destroyed the beds, making new ones necessary, plus the added cost of disking. It also would have delayed planting. Airplane spraying with chemicals at once suggested itself and the Medlock Flying Service was called in. Some careful preliminary trials were made in cooperation with the chemical companies and the Spreckels Sugar Company. The formula arrived at was 15 gallons of weed oil and one quart of Sinox General (a dinitro fortifier) per acre. The cost was $6.20 per acre for the material plus the application. Several weeks after the application and ground had dried sufficiently, the top of the beds were leveled off and the fields were planted. A few new weeds came up with the beets, but normal cultivating and thinning procedure provided adequate weed control. This would not have been possible without first having killed the original weed growth some weeks before.

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H. A. BERGMAN piloted this Medlock Flying Service spray-plane in one of the earliest airplane applications of oil spray on a beet field in 1949.

Since this early work many other growers for the Spreckels Sugar Company followed the pre-planting spray practice. Some of these growers are listed below:

Jack Adams	Kilkenny Bros.
George Barry	Tommy Kunze
Sam Clark	Montgomery and Towne
Arnold Collier	Elwood Olson
Frank Dyer	Bob Schulze
Edgar Everett	Olin H. Timm
Jerry Fielder	John Vanetti
Gill Brothers	Earl Warnken
J. W. Jones	

All of these growers followed a program substantially as follows:

The beds are first listed up roughly in the early fall. The weeds are allowed to germinate with the first early rains. The spray application is then made in December and January. (It has been found important that the weeds not be allowed to get a great deal of growth.) If a good job of weed killing is done when the weeds are small and the ground is not disturbed, the beds remain free of weeds until planting time. When the ground has sufficiently dried out the beds are leveled off in preparation for the seed, and planting is done immediately. The leveling operation just prior to planting is important, as it removes the top layer of the soil which may still contain some of the poisonous spray residue and sprouting weed seeds.

Control of weeds on sugar beet beds by pre-planting spray has many advantages. First, it permits working the ground at a time of the year when it is most advantageous. Secondly, it safely permits killing the weeds without destroying the beds themselves. Third, it permits the sugar beets to emerge relatively free of weeds, and thus permitting more successful mechanical thinning. And fourth, it makes it possible to establish the crop at an earlier date, thus taking advantage of early spring rains and better assuring a good even stand.

CERCOSPORA LEAF SPOT — EFFECTS AND CONTROL METHODS

By WILLIAM DUCKWORTH, *Field Superintendent*
and
DR. RUSSELL T. JOHNSON, *Plant Breeder*
Spreckels Sugar Company

CERCOSPORA LEAF SPOT is one of the most familiar diseases of sugar beets in the Eastern United States, Europe and Japan. Its occurrence in California has, in the past, been limited to the northern Sacramento Valley, with only occasional evidence south of the Colusa-Marysville line.

But in 1953, late August showers provided the combination of heat and moisture favorable to the spread of the disease, and symptoms were observed as far south as Davis. No economic damage was reported in any Spreckels district except those served by the Grimes and Tudor receiving stations. Portions of fields in each area were infected with leaf spot. In parts of two fields, there was a depression in sugar percentage of about 2%. No depression of tonnage was noted.

DESCRIPTION OF THE DISEASE

Cercospora leaf-spot is caused by a parasitic fungus, **Cercospora beticola.** The spores of this fungus are carried to the beet leaves by the wind. If proper temperature and moisture conditions prevail, the spores germinate. The amount of leaf-spot developing from the initial infection is rarely great enough to cause concern; however, should weather conditions favorable to spore formation and growth of the fungus prevail, the disease develops and spreads.

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THESE LEAVES show varying degrees of Cercospora damage. The many circular lesions are typical. When they enlarge and coalesce, the leaves die and cease to store sugar in the beet root.

Temperatures ranging from 80° to 90° F during the day and 60° F or higher at night are ideal for spore formation. Spore formation can not take place if the humidity is not relatively high. Such temperature and humidity combinations occur infrequently in the lower Sacramento Valley.

The fungus causing the disease is dependent upon the sugar beet host for food. This feeding takes from the beets some substances required for growth and interferes with normal development of the beet root and the storage of sugar. The degree to which root growth and percent sucrose is affected will depend on the severity, length of the attack, and the time of the season it occurs. Early prolonged attacks are the most damaging. Except in the Northern Sacramento Valley, the disease has not appeared until relatively late in the growing season, and has not been of a prolonged duration.

The first visible effect of leaf-spot is small whitish spots on the leaf which increase in size quite rapidly at the same time becoming brownish or purplish in color. The border of the spots varies from brown to bright purple. The individual spots are nearly circular, but when very numerous several may become united forming large irregular shaped areas. When the spots are very numerous, the leaves gradually turn yellow and die. The dead leaves remain firmly attached to the crown of the beet making clean topping very difficult.

The most common source of infection is the remains of diseased beet leaves left in the field. Infection may also come from other host plants, some of which are common in local beet growing areas. Pig weed, lamb's quarter, mallow, curled dock and dandelion are common weed hosts.

CONTROL METHODS

Control of this disease by cultural practice other than crop rotation has not been effective. The casual organism reproduces by spores which can be blown about by the wind and carried from one field to another. Therefore, infection can spread from an infected field to a clean field regardless of cultural practices. Another source of infection is debris from a previous beet crop.

By varietal development, the U. S. Department of Agriculture and beet sugar companies east of the Rocky Mountains where the disease has long been a problem, have produced varieties which show considerable resistance to this disease.

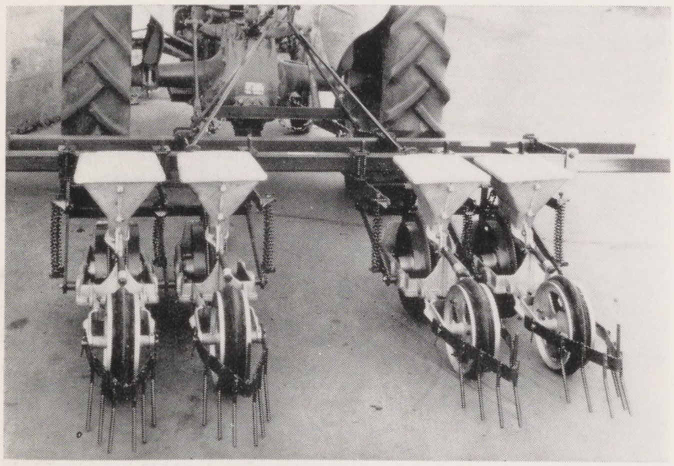
The commercial varieties now grown in the area north of Woodland possess very little if any inherent resistance to this disease. Some experimental varieties which were resistant to leaf spot and developed by the U. S. Department of Agriculture were obtained last spring for test in some of our areas subject to leaf spot damage. The tests were only slightly affected by leaf spot, so damage, if any, was very little. Under such a light infection very little difference was demonstrated between the yields of the experimental varieties and our own commercial varieties. It is probable that if the infection had been severe, the experimental varieties would have been superior to our own. One of these experimental varieties was one developed to incorporate leaf-spot resistance and curly-top resistance into the same variety. This type of variety should seem to be a desirable combination for the northern portion. We have obtained a small amount of seed of that variety from the U. S. Department of Agriculture for the purpose of making non-bolting selections adaptable to the needs of our northern area. More tests are planned for the coming year with experimental varieties in order to determine at the earliest date a variety with suitable characteristics for that area.

IMPROVED MILTON PLANTER IS OFFERED

HARBISON-PAINE, Incorporated of Loveland, Colorado, have announced a series of improvements in the Milton Planter Unit which they have manufactured for several years. Among the improvements are:

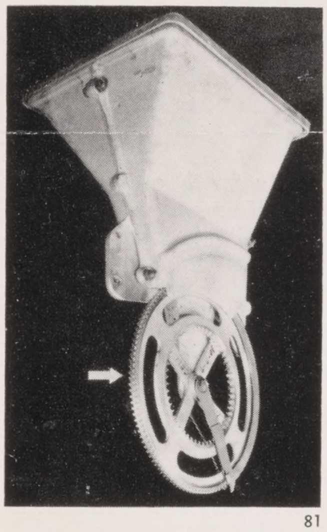
(1) Double Row Seed Wheel (two rows of seed cells permit rotation at slower speed with consequent improvement in cell fill).
(2) Ball Bearings have replaced plain bearings.
(3) A Cover Rake, combined with rubber tire press wheel gives improved germination.
(4) Units are now available for tool bar mounting on any spacing, including 12" and 14" row centers for double-bed planting.

Milton Planters are now available at implement dealers throughout the beet growing areas in California.



Hancock Studio, Loveland, Colo. 80

ABOVE — THE NEW MILTON Planter Units are available for tool bar mounting on any spacing. (Shown here mounted for 12"-28", two-row beds.)



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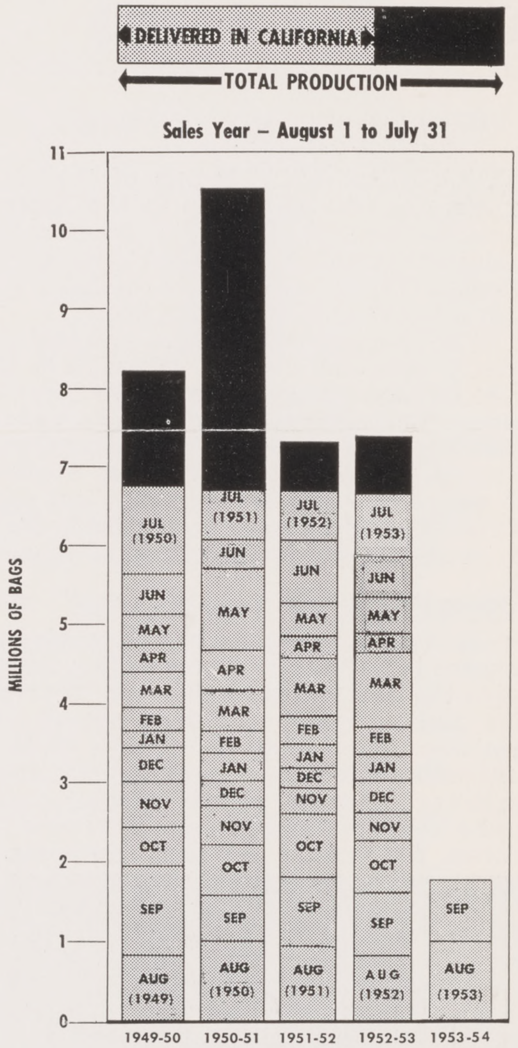
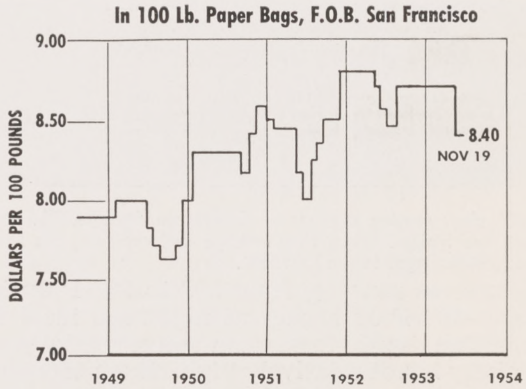
LEFT—TWO ROWS of seed cells (arrow) insure complete cell fill at normal driving speeds.

PRODUCTION AND DELIVERIES OF BEET SUGAR IN CALIFORNIA



QUOTED PRICE OF BEET GRANULATED SUGAR

In 100 Lb. Paper Bags, F.O.B. San Francisco



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All photographs by the editor unless otherwise indicated.
AUSTIN ARMER, Editor 600 California Fruit Building Sacramento, California

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